

# A curriculum framework for Computer Science and Information Technology

Computing at School Working Group

<http://www.computingatschool.org.uk>

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## 1 Overview and intent

At BETT 2012, Michael Gove announced that schools will no longer be required to follow the National Curriculum Programme of Study for ICT, although ICT will remain compulsory right up to the end of Key Stage 4. This announcement leaves a vacuum that begs the following question: **if schools and other learning providers are not going to follow the existing curriculum, what should they follow?**

This document lays out a framework for the answer to that question. It has been developed by the Computing at School Working Group<sup>1</sup> and the British Computer Society<sup>2</sup>; and shared with partner organisations including Naace<sup>3</sup> (the subject association for ICT), ITTE<sup>4</sup> (the association for Information Technology in Teacher Education), and the NextGen Skills campaign<sup>5</sup>.

## 2 A vision for the curriculum

We suggest that a new curriculum in Computer Science and Information Technology should consist of the following three distinct strands:

- **Computer Science** as a discrete discipline (Section 3).
- **Information Technology** as a discrete discipline (Section 3).
- **Digital Literacy**, understood as basic functional skills, such as the ability to use a keyboard, mouse, email, and web browser (Section 4).

A distinct but crucially-important component is the use of information and communication technologies to enhance learning across all disciplines. We use the term is **Technology-enhanced learning (TEL)**, and discuss it in Section 5.

Later sections give more details of what we intend these terms to mean, but the breakdown is precisely that recommended by the Royal Society report [Shut down or restart: the way forward for Computing in UK schools](#)<sup>6</sup>. Care is needed: the Royal Society's definitions may differ from the reader's instinctive ones (Section 6).

One reason for distinguishing these elements is that they will almost certainly be delivered in very different ways, as we discuss in the relevant sections. The details will vary from school to school.

This framework is intended to support flexibility and discretion at the institutional level; it is not a detailed prescription. Moreover the framework describes the *goal* we would like to achieve, not the *journey* for getting there. In practice we will need to move in small steps towards the goal, and the route will differ between different providers depending on their respective strengths and priorities.

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<sup>1</sup> <http://www.computingatschool.org.uk>

<sup>2</sup> <http://www.bcs.org/>

<sup>3</sup> <http://www.naace.co.uk/>

<sup>4</sup> <http://www.itte.org.uk/>

<sup>5</sup> <http://www.nextgenskills.com/>

<sup>6</sup> <http://royalsociety.org/education/policy/computing-in-schools/report/>

### 3 Computer Science and Information Technology

It is helpful to distinguish two complementary disciplines:

- **Computer Science** is the study of the foundational principles and practices of computation and computational thinking, and their application in the design and development of computer systems. A [model curriculum for Computer Science](#) has been offered by the Computing at School Working Group.
- **Information Technology** deals with the creative and productive use and application of computer systems, especially in organisations, including considerations of e-safety, privacy, ethics, and intellectual property. Naace has recently developed a [KS3 Curriculum for ICT](#), and plans to add further detail.

The following table compares the two disciplines (at school level).

Information Technology	Computer Science
How computer systems are used	How computer systems work
People are central to the subject	Computation is central to the subject
Concerned with the development of IT systems, with particular emphasis on the effects on end users	Concerned with algorithmic thinking, and the ways in which a real-world problem can be decomposed in order to construct a working solution
Focuses on building a business / application solution mainly by using a combination of currently available software	Develops new systems by writing new software.
Emphasis on choosing and evaluating, appropriate software	Emphasis on principles and techniques for building new software (or hardware). Programming is a central technique.
Information Technology supports human activity	Computation is a “lens” through which we can understand the natural world, and the nature of thought itself, in a new way.
Tending towards applied/vocational	Tending towards academic

As the Royal Society Report affirms:

**Both Computer Science and Information Technology are disciplines that can and should be encountered by every child, from primary school onwards.**

We do not amplify the case for either discipline here, since that is done adequately elsewhere, notably in the Royal Society Report. But it is crucial to note that both are proper, rigorous disciplines, not low-level functional skills. A good model for the relationship between CS and IT is that between English Language and English Literature, or that between

Physics and Chemistry, or between Mathematics and Engineering: they are complementary but related.

- **Primary school.** Every child should meet both CS and IT at primary school, although they will not be taught in discrete lessons any more than physics is. Nevertheless although the students may be unaware of the distinction, it is important for the *teacher* to be aware of their separate learning objectives, just as he or she is aware of the learning objectives of history and mathematics, both being learned though a thematic study of the Egyptians.
- **Key Stage 3.** Both disciplines should continue through Key Stage 3. Schools may well differ in the extent to which the two are visibly differentiated at the start of KS3 but clear distinctions should be visible by Year 9 to allow pupils to make informed choices for KS4.
- **Key Stage 4.** At KS4 there should be a range of GCSEs, with students free to choose to study both disciplines, or one, or neither<sup>7</sup>. By analogy, students may choose Physics but not Chemistry at GCSE. A much wider range of GCSEs than at present would be very desirable, ranging from an unashamedly academic GCSE in Computer Science at one end, to more applied/vocational KS4 qualifications in IT at the other, with possible intermediate points for qualifications such as Systems Administration, Web Development, or Creative Multimedia in the middle.
- **Post 16.** At A level, there are distinct A levels in the two disciplines.
- **Project based learning, cross-curricular themes, competitions, and out of school clubs,** have a significant role to play in both disciplines.

We envisage that schools will differ in the relative emphasis they give to Computer Science and Information Technology, depending on the needs of their students.

## 4 Digital Literacy

Just as the ability to read, spell, punctuate, and perform basic arithmetic, are essential life skills, so is the ability to use a computer. **Digital Literacy** is the ability to use computer systems confidently and effectively, including

- Basic keyboard and mouse skills.
- Simple use of 'office applications' such as word processing, presentations and spreadsheets.
- Use of the Internet, including browsing, searching and creating content for the Web, communication and collaboration via e-mail, social networks, collaborative workspace and discussion forums.

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<sup>7</sup> "ICT" will remain a compulsory subject to the end of KS4, until September 2014 when the new National Curriculum begins; at that stage it seems likely to lose its statutory status at KS4. So until that date the "or neither" option can be sustained only by arguing that enough ICT is taking place elsewhere in the curriculum. This is precisely the situation in many UK schools today which do not have discrete ICT at KS4.

Digital literacy is not an extra subject, any more than numeracy is. It is simply a basic functional skill that students must possess to function as citizens, or indeed as students. The definition is deliberately a narrow one. *We intend “Digital Literacy” to connote those skills that (say) a history teacher can assume his students have, just as he can assume they can spell and do simple mental arithmetic.* This narrow definition is consistent with the way that “literacy” and “numeracy” are used in the rest of the curriculum. Just as we would hope that any well-educated student would be more than merely literate in English, we would expect them to be more than digitally literate in Information Technology. We specifically do not intend “Digital Literacy” to connote the higher-level information handling skills that are part of Information Technology (Section 3).

Digital literacy does need to be learned: young people have usually acquired some knowledge of computer systems, but their knowledge is patchy. In terms of delivery, digital literacy can be treated much like literacy and numeracy are dealt with at school:

- Discrete lessons and teaching embedded within the broader curriculum throughout primary education. By the time students arrive at secondary school, most should be digitally literate, just as they should be numerate.
- Booster classes and/or extra learning opportunities for any students (a minority) whose digital literacy is holding them back in secondary school.
- Opportunities for pupils to apply, reinforce, and develop these skills through in all subject areas throughout primary and secondary education.

The details can and should vary from school to school.

## 5 Technology-enhanced learning (TEL)

Every provider should make astute and effective use of digital technology to support teaching and learning across the curriculum (there is a useful [Wikipedia article](#)<sup>8</sup> with this title). When there is a clear focus on learning rather than technology, systems such as interactive whiteboards, virtual learning environments, blogs, wikis, podcasts, video and mobile devices can have a transformative impact on both learning and teaching. Pupils' use of such technology both draws on and enhances their digital literacy.

Within specific curriculum subjects, technology can enable entirely new forms of learning. Examples abound:

- Computer Aided Design software enables designs to be carried out in detail before taking shape physically.
- Drama and media studies lessons may use video cameras, editing suites and programmable studio lighting systems.
- Image editing software and vector graphics provides an additional medium for art and design. The technology is also used to enhance the presentation of traditionally created works.

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<sup>8</sup> [http://en.wikipedia.org/wiki/Technology-Enhanced\\_Learning](http://en.wikipedia.org/wiki/Technology-Enhanced_Learning)

- Geographical Information Systems (GIS) allow location based data to be explored and analysed. Through the use of Global Positioning Systems, learners can create their own data maps as well as explore and discover in the local environment.

The skilled and imaginative use of such technologies in specific subjects can enhance traditional teaching and enable new approaches to teaching and learning. In each case,

- Subject knowledge and understanding of the “host discipline” (music, or electronics) is primary, with information technology and software skills playing a subsidiary, enabling role.
- The effective use of sophisticated packages requires creative and knowledgeable users, going beyond the more functional digital literacy skills of simply using the software.

The purpose of using technology in this way should be to improve learning in that subject, *and not a back-door way to teach IT or Computing*. TEL is not part of the curriculum in the way that CS, IT, and DL are. There should be no laid-down programme of study, no attainment targets, no assessment. The technology serves learning; it is not the object of learning. It follows that:

- The use of technology in other subjects (English, say, or Geography) should be assessed by Ofsted as part of the school’s teaching and learning in that subject, not as part of its delivery of the National Curriculum subject ICT.
- The extent and nature of the use of technology in other subjects should be driven exclusively by the needs of those subjects, and not by the needs of any technology curriculum. Nevertheless, it would be extraordinary for any subject to make no use of technology.

## 6 A note on terminology

Computing is an area that is bedevilled by terminology. In this document we have adopted the following terms, precisely as recommended by the Royal Society report (page 5):

- “**ICT**” has come to mean many different things to different people. The RS report (recommendation 1) says “The term ICT should no longer be used as it has attracted too many negative connotations”. We have adopted this principle in this Framework; in doing so we do not in any way disparage much good teaching and learning that currently goes under the ICT banner.
- “**Computer Science**”: the discipline. School teachers often use the term “Computing” but that usage is not common outside the school teaching profession, whereas Computer Science is absolutely unambiguous.
- “**Information Technology**”: the discipline. The creative and productive application of digital technology, in industry, commerce, the arts, and elsewhere. As the RS report notes (page 5) this use of the term is somewhat narrower than its common use in industry, which generally encompasses Computer Science.

- **“Computer Science and Information Technology”** is used here as an overarching term to embrace all things digital, including computer science, and information technology, digital literacy, and technology to enhance learning.
- **“Digital Literacy”** is used here in a narrow sense: the basic ability to use a computer system. To quote the Royal Society definition: “The general ability to use computers. This will be written in lower case to emphasize that it is a set of skills rather than a subject in its own right.” We are aware that there are other, more far-reaching definitions of digital literacy, such as that offered by the [FutureLab report](#)<sup>9</sup> “It’s not chalk and talk anymore: school approached to developing students’ digital literacy”, but *for the purposes of this document* these more ambitious goals are encompassed by Information Technology.
- **“ICT across the curriculum (ICTAC)”** was an approach to delivering the National Curriculum in ICT through teaching and learning in other subjects. As such, it is quite different to Technology to Enable and Enhance Learning, where the emphasis is solely on learning in the other subject.

No set of terms will suit everyone.

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<sup>9</sup> <http://www.futurelab.org.uk/resources/digital-literacy-across-curriculum-handbook>