Computing Education in England+ Draft Unchecked Slides

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Education is devolved in the UK

When the Westminster Government announces,say, £100M for education, certain "Barnett" amounts are made available to the Governments/Administrations in Northern Ireland, Scotland and Wales, and the rest (say £84M) is available for Westminster to spend in England.
There is no requirement for the devolved sums to be spent on the same subject.
Hence I am largely talking about England.

Overall timeline

- 2012 [Roy12] "Shut down or restart: the way forward for computing in UK schools"
- 2014 New National Curriculum in England requires Computing
- 2015 [Dep15] "Degree Apprenticeships" launched
- 2016 [Sir16] Shadbolt Review of Computer Sciences Degree Accreditation and Graduate Employability.
- 2017 [Dep17] Competition for National (=England) "Institute of Coding" £20M+Matching
- 2017 [Roy17] "After the reboot: computing education in UK schools"
- 2018 [Her18] PM at Davos announces Institute of Coding to a consortium led by Bath.
- 2018 [Dep18] £100M for UK Computing Education in Schools: England's National Centre for Computing Education (STEM Learning, Raspberry PI, BCS)

Schools in England (Scotland very different)

–14 Compulsory curriculum

15,16 Study Maths, English, Science and 3–7 other subjects (GCSEs)

EBacc English; Maths; Double or triple science (including Computing); History or geography; A language

State school league tables are based very largely on EBacc/GCSE results

16 Can leave school (typically 50%)

17,18 Study typically 3 subjects (e.g. Maths, Further Maths, Physics) at A-level, though other routes exist

18+ University (vast majority of A-level students), typically a narrow subject (e.g. Computer Science) from day 1.

The English educational system is among the most specialised in the world

National Curriculum (England) [Dep13] since Sept. 2014

The national curriculum for computing aims to ensure that all pupils:

- can understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation
- can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems
- can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems
- are responsible, competent, confident and creative users of information and communication technology

National Curriculum (England) [Dep13] details

- design, write and debug programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts
- use sequence, selection, and repetition in programs; work with variables and various forms of input and output
- use logic[. . .] to explain how some simple algorithms work and to detect and correct errors in algorithms and programs
- understand computer networks including the internet; how they can provide multiple services, such as [WWW . . .]
- use search technologies effectively, [. . .] and be discerning in evaluating digital content
- select, use and combine a variety of software (including internet services) [. . .]
- use technology safely, respectfully and responsibly; recognise acceptable/unacceptable behaviour; identify a range of ways to report concerns about content and contact.

By age 11!

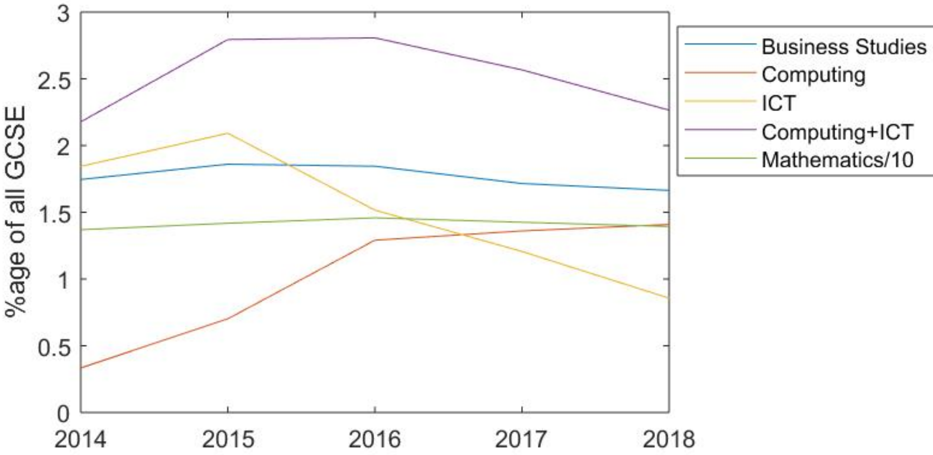
National Curriculum (England) [Dep13] Age 14 I

- design, use and evaluate computational abstractions that model the state and behaviour of real-world [. . .]
- understand several key algorithms that reflect computational thinking; [. . .] compare the utility of alternative algorithms
- use two or more programming languages, at least one of which is textual, to solve a variety of computational problems; make appropriate use of data structures; design and develop modular programs that use procedures or functions
- understand simple Boolean logic and some of its uses in circuits and programming; understand how numbers can be represented in binary, and be able to carry out simple operations on binary numbers
- understand the hardware and software components that make up computer systems, and how they communicate with one another and with other systems

National Curriculum (England) [Dep13] Age 14 II

- understand how instructions are stored and executed within a computer system; understand how data of various types (including text, sounds and pictures) can be represented and manipulated digitally, in the form of binary digits
- undertake creative projects that involve selecting, using, and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users
- create, re-use, revise and re-purpose digital artefacts for a given audience, with attention to trustworthiness, design and usability
- understand a range of ways to use technology safely, respectfully, responsibly and securely, including protecting their online identity and privacy; recognise inappropriate content, contact and conduct and know how to report concerns.

Has it worked: GCSE (age $\sim$ 16) [OFQ18]

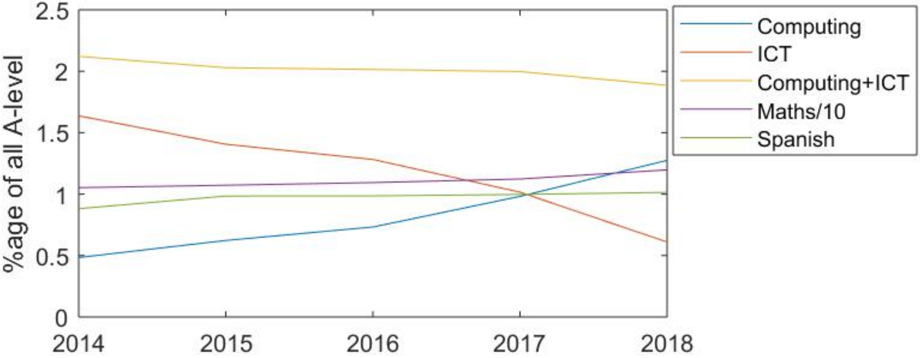


Note many children take 7 GCSE, and Maths is often repeated until passed.

Computing markedly up; ICT (wordprocessing etc.) markedly down

2016 is when the National Curriculum would first have affected

Has it worked: A-levels (age $\sim$ 18) [OFQ18]



Note most children take 3 A-levels.
Computing markedly up; ICT (wordprocessing etc.) markedly down
However, about 25,000 students/year study CS, so the A-level isn't taken by nearly enough (9685 in 2018) to make it a pre-requisite, unlike most other sciences

Achieved How?

A new Curriculum doesn't imply any new resources.

Teacher I teach PowerPoint to Business students: I can't teach Python to Computing GCSE

Head You'll pick it up

* She came to my "Python for GCSE Teachers" evening class

Teacher But look at the number of hours!

Head True: have a couple of Physical Education teachers to help you.

NCCE: £84M to retrain existing teachers, much of which goes on buying them out to have time to retrain

Institute Of Coding: aimed at post-18

Launched January 2018 £20M English Government money + Welsh + matching industry/university money. 19 University partners (growing)

1. University Learners, including Accreditation
2. The Digital Workforce (typically Degree Apprentices)
3. Digitalising the Professions (various professions where digital technologies are changing the job such that serious upskilling in necessary)
4. Widening Participation
5. Knowledge Sharing and Sustainability; including

* Observatory: looking at supply/demand trends

Institute Of Coding Accreditation

Accreditation in computing is complex.

- [Bri18] "an accredited programme is one which meets some or all of the educational requirements for registration with BCS as a: Chartered IT Professional; Chartered or Incorporated Engineer."
- In practice it's substantially more than that: group working, large individual projects, legal, social, ethical and professional considerations.
- [Bri18] "The requirement for RITTech is demonstration of competence in employment."
- [EQU15] "knowledge, skills and competences that graduates of an accredited course should have achieved as the educational base for practising their profession or for post-graduate studies."
- IoC [Bow19] "focus fundamentally different: The individual student; Employability; Competence (evidence)"
- International Washington [Was] and Seoul [Seo] Accords.

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