“It’s not the coding curriculum!”: Repositioning CS education reform in the UK

@ProfTomCrick

http://www.computingatschool.org.uk

28 October 2017

COMPUTING AT SCHOOL
EDUCATE · ENGAGE · ENCOURAGE


THE
PROGRAMMING
LANGUAGE
BRIAN W. KERNIGHAN
DENNIS M. RITCHIE
ANSI
#include <stdio.h>
main()
{ printf ("Hello World!\n");

Terminological Diversions

Quotes on the Internet...

"Computer science is no more about computers than astronomy is about telescopes."

~~**Edsger W. Dijkstra**~~
Hal Abelson

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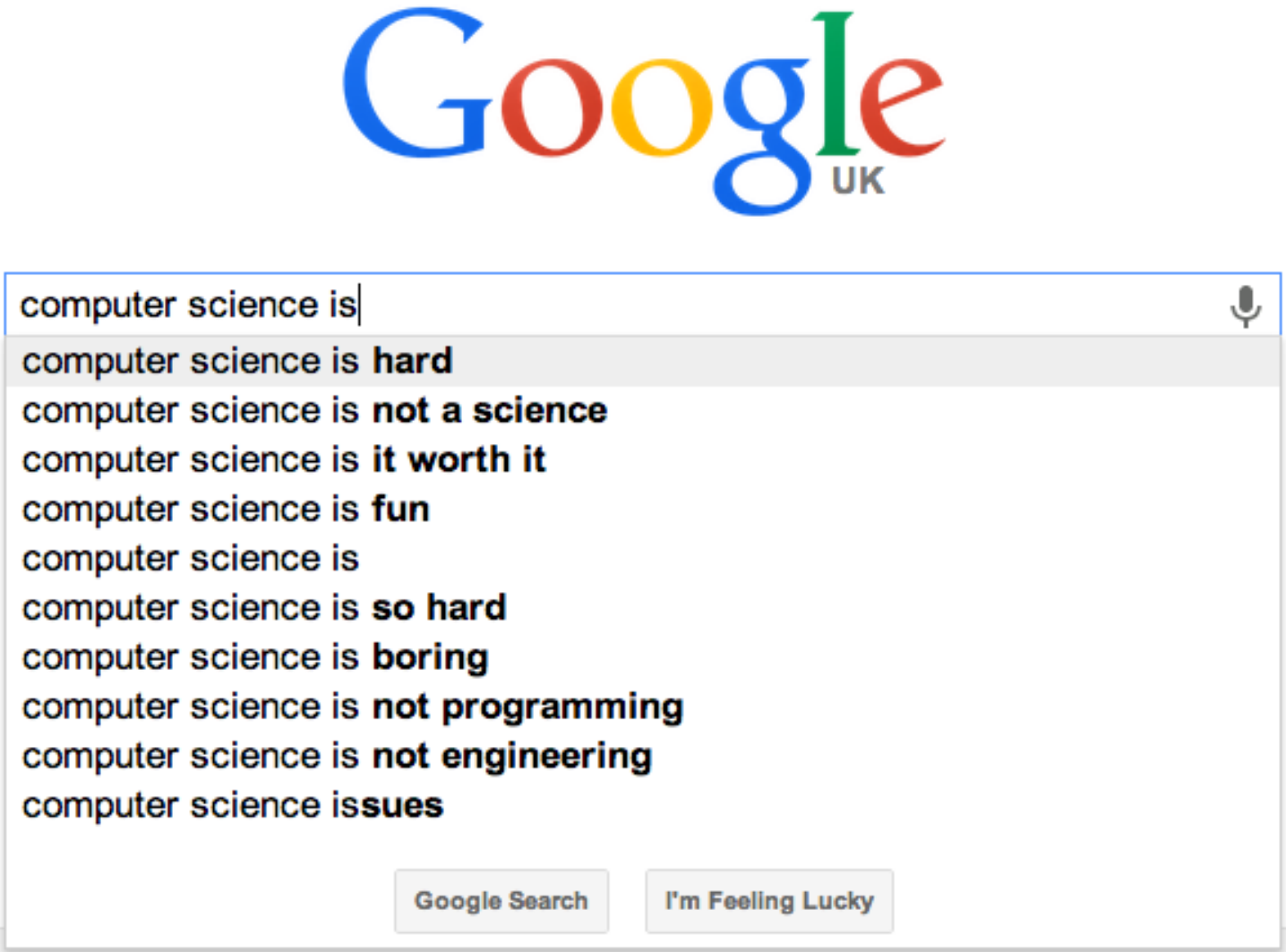
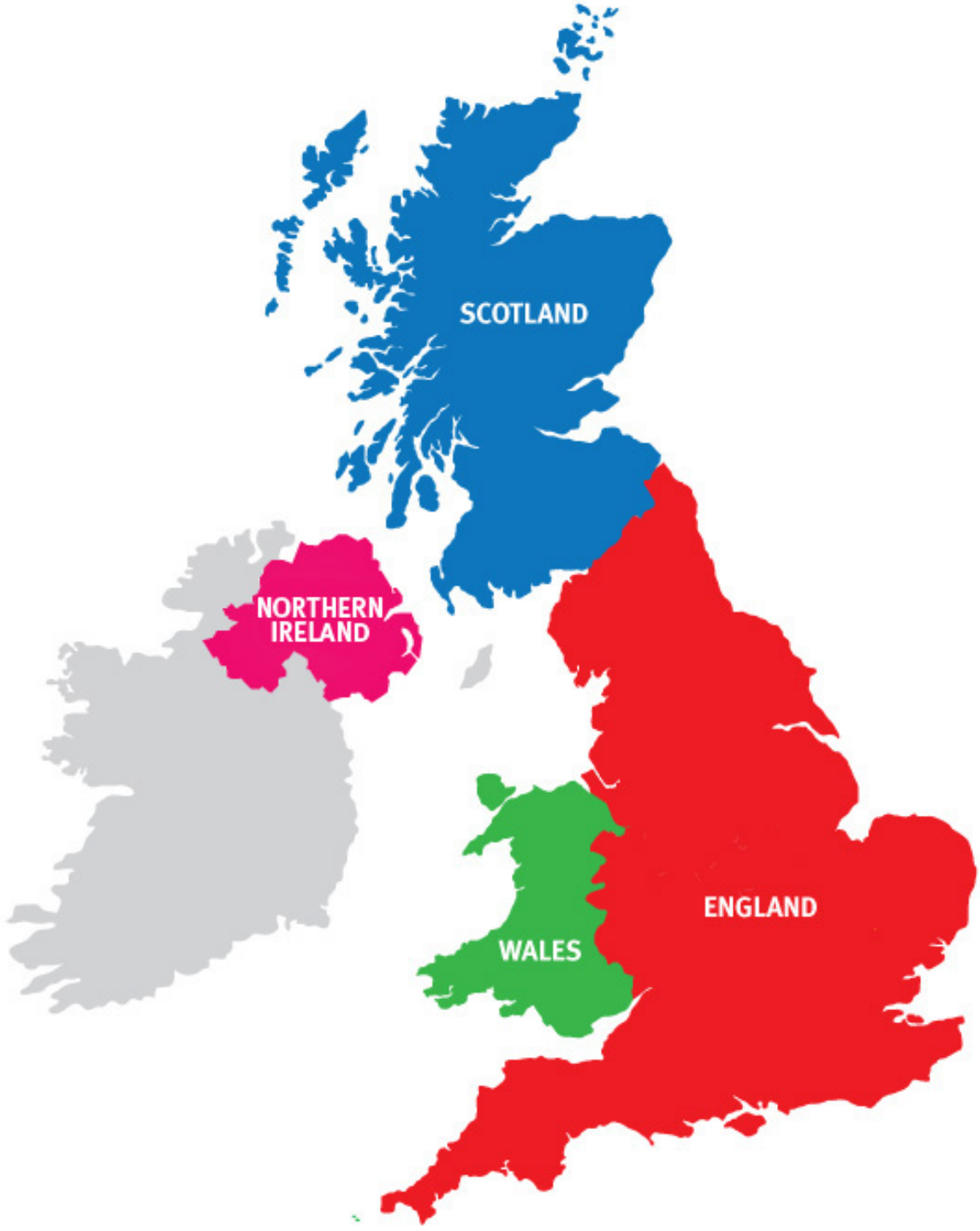

Google
UK
computer science is
computer science is hard
computer science is not a science
computer science is it worth it
computer science is fun
computer science is
computer science is so hard
computer science is boring
computer science is not programming
computer science is not engineering
computer science issues
Google Search
I'm Feeling Lucky
New Priv


SCOTLAND
NORTHERN IRELAND
WALES
ENGLAND

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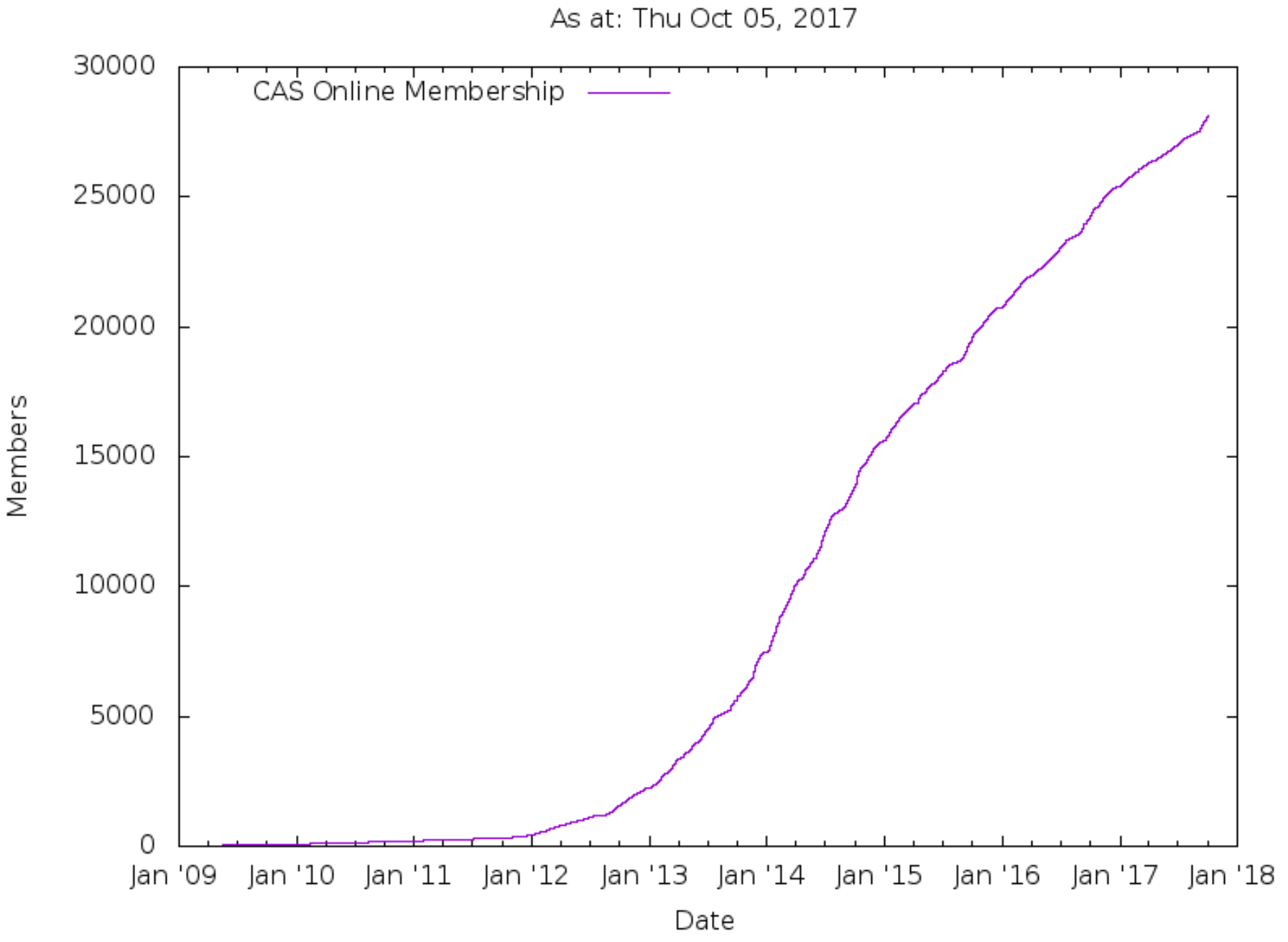
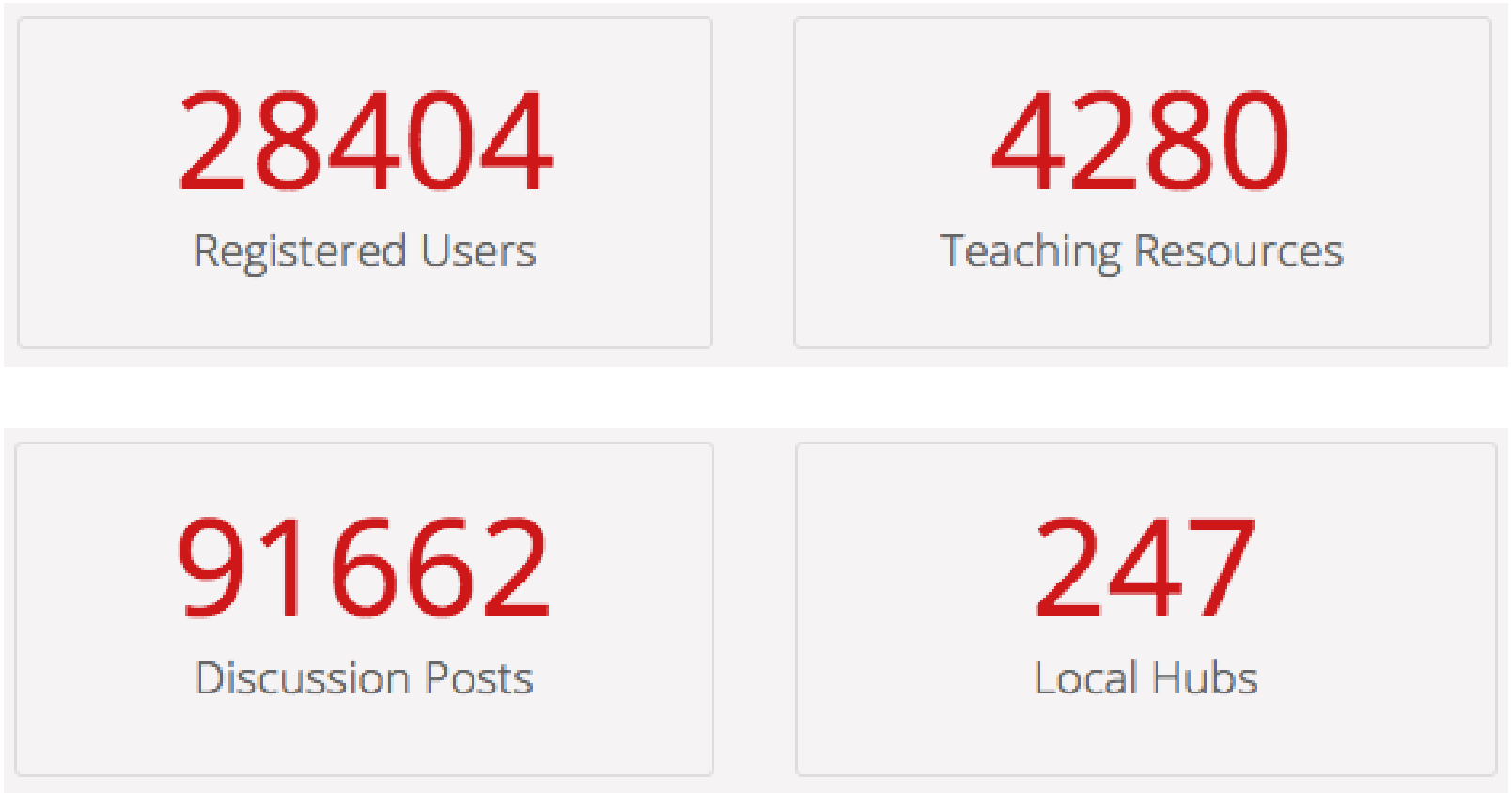
(**join now for free:** `http://community.computingatschool.org.uk`)


As at: Thu Oct 05, 2017
CAS Online Membership
30000
25000
20000
15000
10000
5000
0
Members
Jan '09
Jan '10
Jan '11
Jan '12
Jan '13
Jan '14
Jan '15
Jan '16
Jan '17
Jan '18
Date

The CAS Community



NETWORK OF EXCELLENCE

COMPUTER SCIENCE TEACHING

https://helloworld.raspberrypi.org

ICT victory for the coding campaigners

Rory Cellan-Jones
Technology correspondent

13 January 2012 | Technology

Back from Las Vegas, I find that it has been a bumper week for technology news in the UK. Ofcom has revised the terms under which 4G mobile broadband will be rolled out, ensuring that 98% of the country will get coverage - though worries remain about how far the UK has fallen behind.

The current ICT curriculum is to be scrapped

Virgin has doubled the speeds available to its broadband customers. And the US movie streaming giant Netflix has launched in the UK, providing new competition to Lovefilm.

More from Rory

Are teachers ready for the coding revolution?

Rory Cellan-Jones
Technology correspondent

23 January 2014 | Technology

Share

Education Secretary, Michael Gove:, attending the Bett learning technology show in London

Children's tech

Coding at school: a parent's guide to England's new computing curriculum

From the start of the new term, children as young as five will be learning programming skills in the classroom

This article is 3 years old

5,551 129

Stuart Dredge

@stuartdredge

Thursday 4 September 2014 12.32 BST

Coding is on the curriculum for primary and secondary school pupils in the UK. Photograph: Alamy

Why Estonia Has Started Teaching Its First-Graders To Code

Parmy Olson, FORBES STAFF
I cover agitators and innovators in mobile. **FULL BIO**
Opinions expressed by Forbes Contributors are their own.

Estonia wants its kids to be [+]

Estonia, a small country with a population of 1.3 million people, punches above its own weight when it comes to advancements in tech. It was the birthplace of Skype, one of the first countries to have a government that was fully e-enabled, and now it has launched a nationwide scheme to teach school kids from the age of seven to 19, how to write code. The idea isn't to start churning out app developers of the future, but people who have smarter relationships with technology, computers and the Web .

The New York Times

INTERNATIONAL EDUCATION

Adding Coding to the Curriculum

By BETH GARDINER
MARCH 23, 2014

LONDON — Estonia is teaching first graders how to create their own computer games and offering scholarships to entice more undergraduates into technology-driven disciplines. In England, an updated national curriculum will soon expose every child in the state school system to computer programming, starting at age five. The American "Hour of Code" effort says it has already persuaded 28 million people to give programming a try.

Around the world, students from elementary school to the Ph.D. level are increasingly getting acquainted with the basics of coding, as computer programming is also known. From Singapore to Tallinn, governments, educators and advocates from the tech industry argue that it has become crucial to hold at least a basic understanding of how the devices that play such a large role in modern life actually work.

UK schools + Add to myFT

Curriculum experts say coding is essential in a digital economy

Developing computational thinking helps students to better understand the world around them

3 Save to myFT

MAY 4, 2016 by Jane Bird

Many of us happily drive a car without understanding what goes on under the bonnet. So is it necessary for children to learn how to program computers? After all, some experts say coding is one of the human skills that will become obsolete as artificial intelligence grows.

Catalysts for Policy Change

"I was flabbergasted to learn that today computer science isn't even taught as standard in UK schools. Your IT curriculum focuses on teaching how to use software, but gives no insight into how it's made."

Eric Schmidt, Executive Chairman, Google (August 2011)


NESTA
Making Innovation Flourish
Next Gen.
Transforming the UK into the world's leading talent hub for the video games and visual effects industries
A Review by Ian Livingstone and Alex Hope
Little Big Planet 2
copyright Sony Computer Entertainment


Shut down or restart?
The way forward for computing in UK schools
January 2012
EXCELLENCE IN SCIENCE
THE ROYAL SOCIETY
The Royal Academy of Engineering

Program or Be Programmed?

"For the majority, the world of software is a built world that, like a city, helps us to organise and consume. But it has been built by others. For the minority, software is merely a curtain that can be pulled aside to reveal a wild world of confusion, trial and error, but also of virtually unlimited creative and commercial potential. It is time for British schoolchildren to be granted access to this world."

The Times (November 2012)

Press release

Government plans to make the UK one of the most digitally-skilled nations

From: Department for Culture, Media & Sport, The Rt Hon Karen Bradley MP, The Rt Hon Robert Halfon MP and Department for Education
First published: 1 October 2016
Part of: Further education and training

Government has announced plans to make training in basic digital skills free for adults lacking relevant qualifications.

Committees
All committees A-Z
Lords Select
Digital Skills Committee
Role
Membership
News
Publications
Timeline
Contact us

Lords Select Committee

Digital Skills Committee

Committee hears from some of the UK's leading technology specialists

Lords ask whether a digital skills deficit is harming UK plc

Committee to question Microsoft, Google and technology experts

Watch / Listen

Watch Baroness Morgan of Huyton, Chair, talk about the role of the Committee

Sci & Tech Committee @CommonsSTC · 3h

We've published a report calling on the Govt to improve training in #DigitalSkills goo.gl/CrnKZH

42 19

Pupils need internet lessons to thrive online, say Lords

By Judith Burns
Education reporter

21 March 2017 | Education & Family | Share

Learning to survive in a world dominated by the internet should be as important for children as reading and writing, says a House of Lords report.

Lessons about online responsibilities, risks and acceptable behaviour should be mandatory in all UK schools, the Lords Communications Committee argues.

Policy paper

UK Digital Strategy

From: Department for Culture, Media & Sport and The Rt Hon Karen Bradley MP
Part of: Further education and training, Research and development, Broadband investment, and UK economic growth
First published: 1 March 2017

This strategy sets out how we will build on our success to date to develop a world-leading digital economy that works for everyone.

Mathematics

How algorithms rule the world

The NSA revelations highlight the role sophisticated algorithms play in sifting through masses of data. But more surprising is their widespread use in our everyday lives. So should we be more wary of their power?

Leo Hickman

Monday 1 July 2013
18.32 BST

Last updated: November 11, 2015 6:01 pm

TalkTalk warns cyber attack costs could rise to £35m

Daniel Thomas, Telecoms Correspondent

Are your medical records in danger?

Nick Triggle
Health correspondent

28 January 2014 | Health

Householders across England have started receiving leaflets about a new NHS scheme called Care.data.

More from Nick

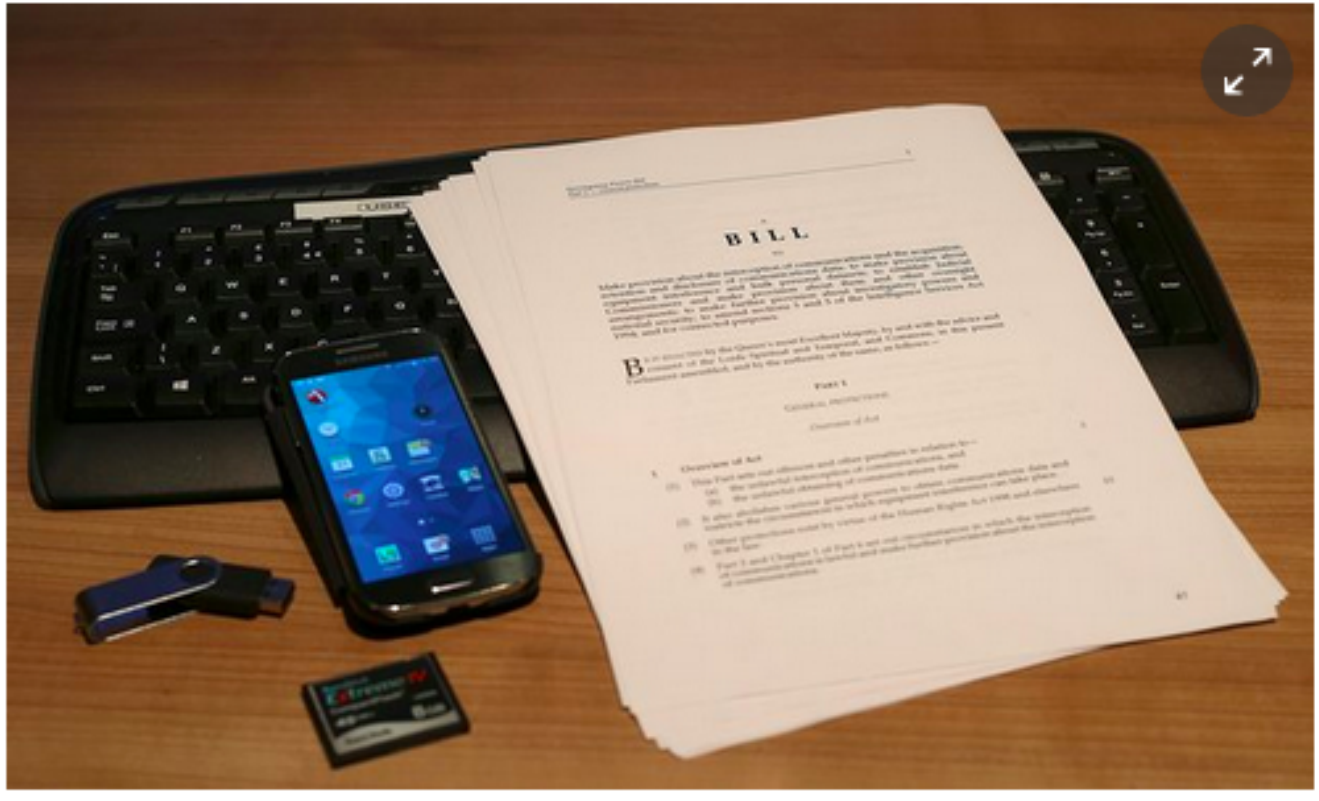
Surveillance

'Extreme surveillance' becomes UK law with barely a whimper

Investigatory Powers Act legalises range of tools for snooping and hacking by the security services

Ewen MacAskill

Saturday 19 November 2016 07.00 GMT



The Investigatory Powers Act was passed on Thursday. Photograph: Philip Toscano/PA

Digital media

Fake news clampdown: Google gives €150,000 to fact-checking projects

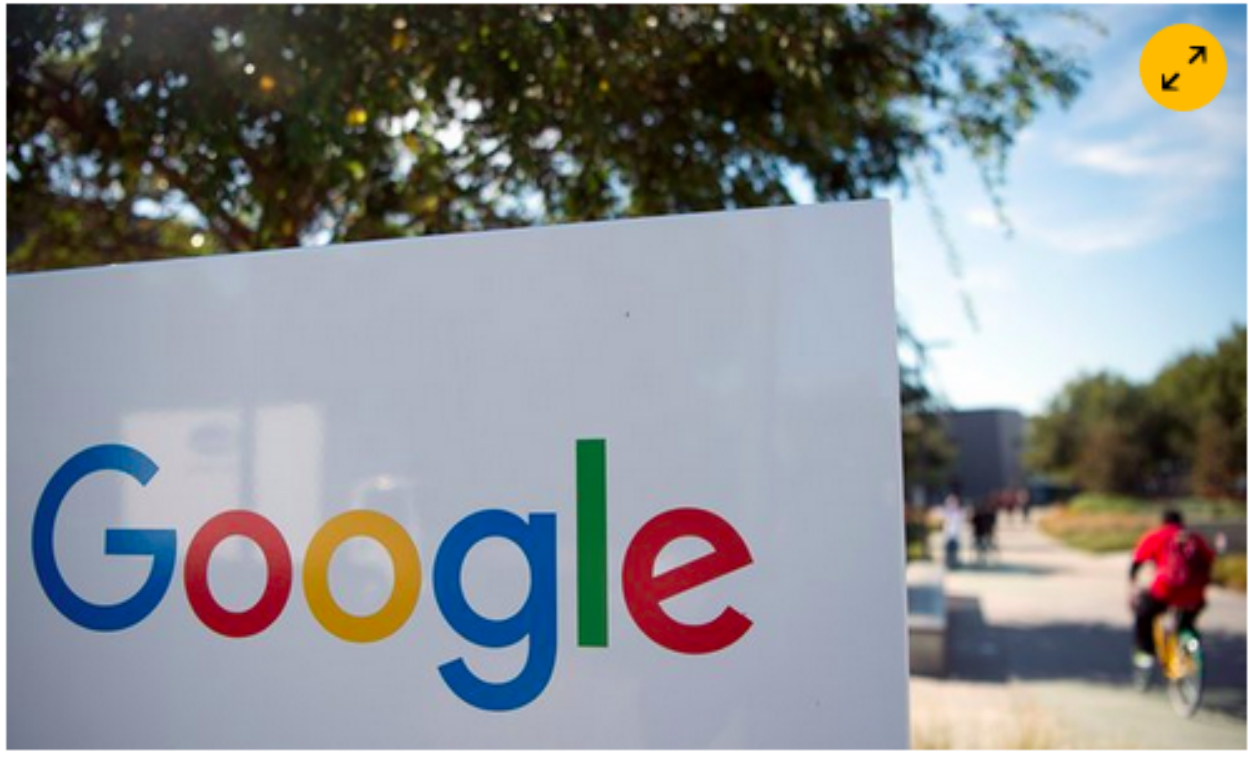
Funding comes amid debate about role of the search engine in spreading bogus content some say influenced US election

Jasper Jackson

@JaspJackson

email

Thursday 17 November 2016 14.58 GMT



Google has come under criticism along with Facebook for their part in the spread of fake news. Photograph: Josh Edelson/AFP/Getty Images

Google has given €150,000 to three UK organisations working on fact-checking projects to help journalists and the public avoid falling for fake stories and bogus claims.

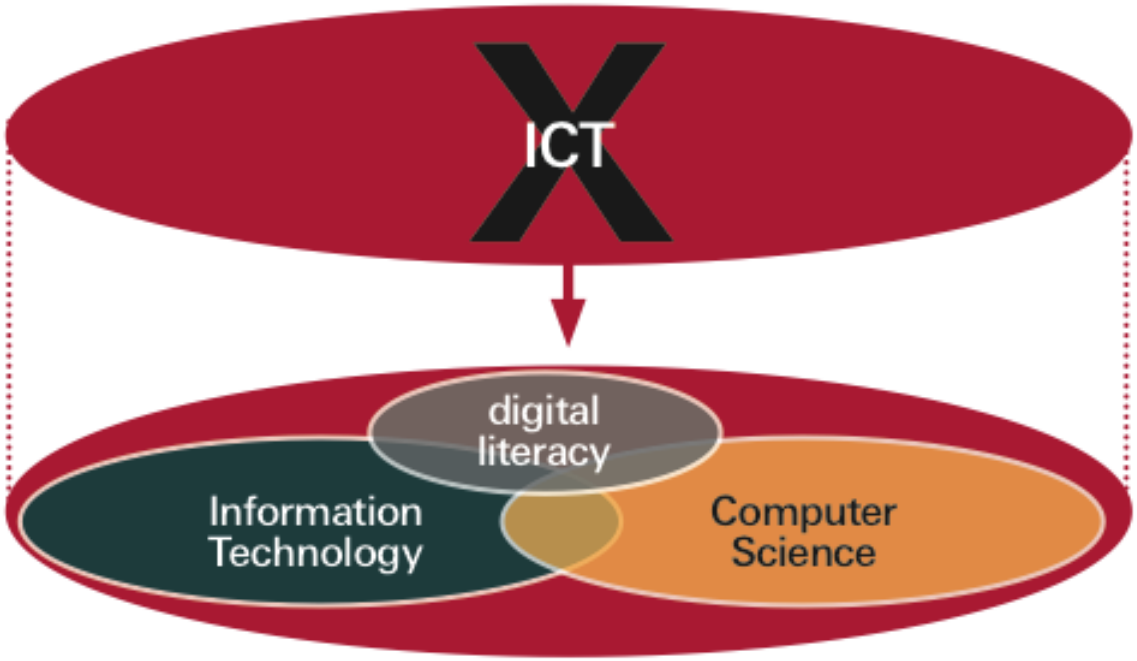
Why not ban cars, Amber Rudd? It'd be more effective than banning encryption

Op-ed: Another terrorist attack, another government attempt at backdooring WhatsApp.

SEBASTIAN ANTHONY - 27/3/2017, 12:59

Changing Names, Changing Aims

Suggested terminological reform



Statutory guidance

National curriculum in England: computing programmes of study

Published 11 September 2013

Contents

Aims

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.

Purpose

"A high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world."

Computing Programmes of Study (2013)

Computational Thinking

"Computational thinking is the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent."

Jeannette M. Wing (2008)


Automation
Abstraction
Parallelisation
Simulation
Decomposition
Algorithm Design
Data Analysis
Pattern Generalisation
Data Representation
Data Collection
Computational thinking
Pattern Recognition

Key stage 1

Pupils should be taught to:

- understand what algorithms are, how they are implemented as programs on digital devices, and that programs execute by following precise and unambiguous instructions
- create and debug simple programs
- use logical reasoning to predict the behaviour of simple programs
- use technology purposefully to create, organise, store, manipulate and retrieve digital content
- recognise common uses of information technology beyond school
- use technology safely and respectfully, keeping personal information private; identify where to go for help and support when they have concerns about content or contact on the internet or other online technologies

Benefits of Computational Thinking?

- Confidence in dealing with **complexity**;
- **Persistence** in working with difficult problems;
- Tolerance for **ambiguity**;
- The ability to deal with **open-ended problems**;
- The ability to **communicate and work with others** to achieve a common goal or solution.

Challenges of Teaching Programming

- "*But not everyone will be a programmer!*" '
- Are we actually teaching problem-solving?

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- **Importance of high-quality pedagogies for learning and assessment**

The Art, Science, and Engineering of Programming

An Analysis of Introductory Programming Courses at UK Universities

Ellen Murphy[1], Tom Crick[2], and James H. Davenport[3]

The Art, Science, and Engineering of Programming, 2017, Vol. 1, Issue 2, Article 18

Submission date: 2016-12-02
Publication date: 2017-04-01
DOI: https://doi.org/10.22152/programming-journal.org/2017/1/18 ⇗
Full text: PDF ⇗

CSUnplugged: CS Without a Computer

Computer Science without a computer

`http://csunplugged.org`

CAS Barefoot: CS/CT Knowledge

https://barefootcas.org.uk

The Computational Thinker: Concepts & Approaches

Concepts

- **Logic** predicting & analysing
- **Algorithms** making steps & rules
- **Decomposition** breaking down into parts
- **Patterns** spotting & using similarities
- **Abstraction** removing unnecessary detail
- **Evaluation** making judgement

Approaches

- **Tinkering** experimenting & playing
- **Creating** designing & making
- **Debugging** finding & fixing errors
- **Persevering** keeping going
- **Collaborating** working together

Barefoot Computing

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www.barefootcas.org.uk

Barefoot would like to acknowledge the work of Julia Briggs and the eLIM team at Somerset County Council for their contribution to this poster.

Computer Science Concepts

Barefoot Computing
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Programming

Sequence


Repetition

Selection

Variables


Inputs


Outputs

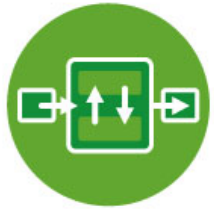

Control


Simulation


Data


Computer Networks


Internet Services


Computer Systems


Search Technologies

www.barefootcas.org.uk

QuickStart Computing: Transitions

http://bit.ly/qsks3

CAS Tenderfoot: CPD

https://www.computingatschool.org.uk/custom_pages/56-tenderfoot

Project Quantum: Effective Assessment

Project Quantum - A Collection of Computing Quizzes

Project Quantum is an ambitious project to crowd source a bank of high quality multiple choice questions for assessing computing in schools, developed jointly by Computing At School, The Centre for Evaluation and Monitoring (CEM), Cambridge Assessment and the Diagnostic Questions team.

`https://diagnosticquestions.com/Quantum`

Bebras: International Challenge on Informatics and CT

http://www.bebras.org

Llywodraeth Cymru
Welsh Government

Learning Wales
Raising Standards Together

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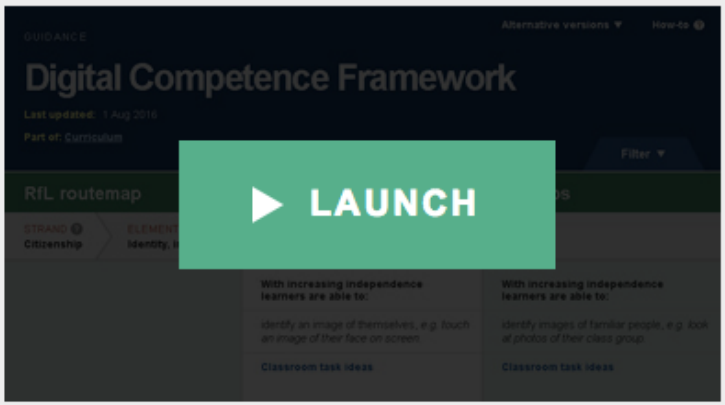
GUIDANCE

Digital Competence Framework

Last updated: 1 Sep 2016

Part of: Curriculum

The Framework encapsulates the skills that will help learners thrive in an increasingly digital world.



Digital competence is one of 3 cross-curricular responsibilities, alongside literacy and numeracy. It focuses on developing digital skills which can be applied to a wide range of subjects and scenarios.

The Framework, which has been developed by practitioners from Pioneer Schools, supported by external experts, has 4 strands of equal importance, each with a number of elements.

The Educational Challenge

What does being "digitally competent" mean for a 4/8/12/16 year old?

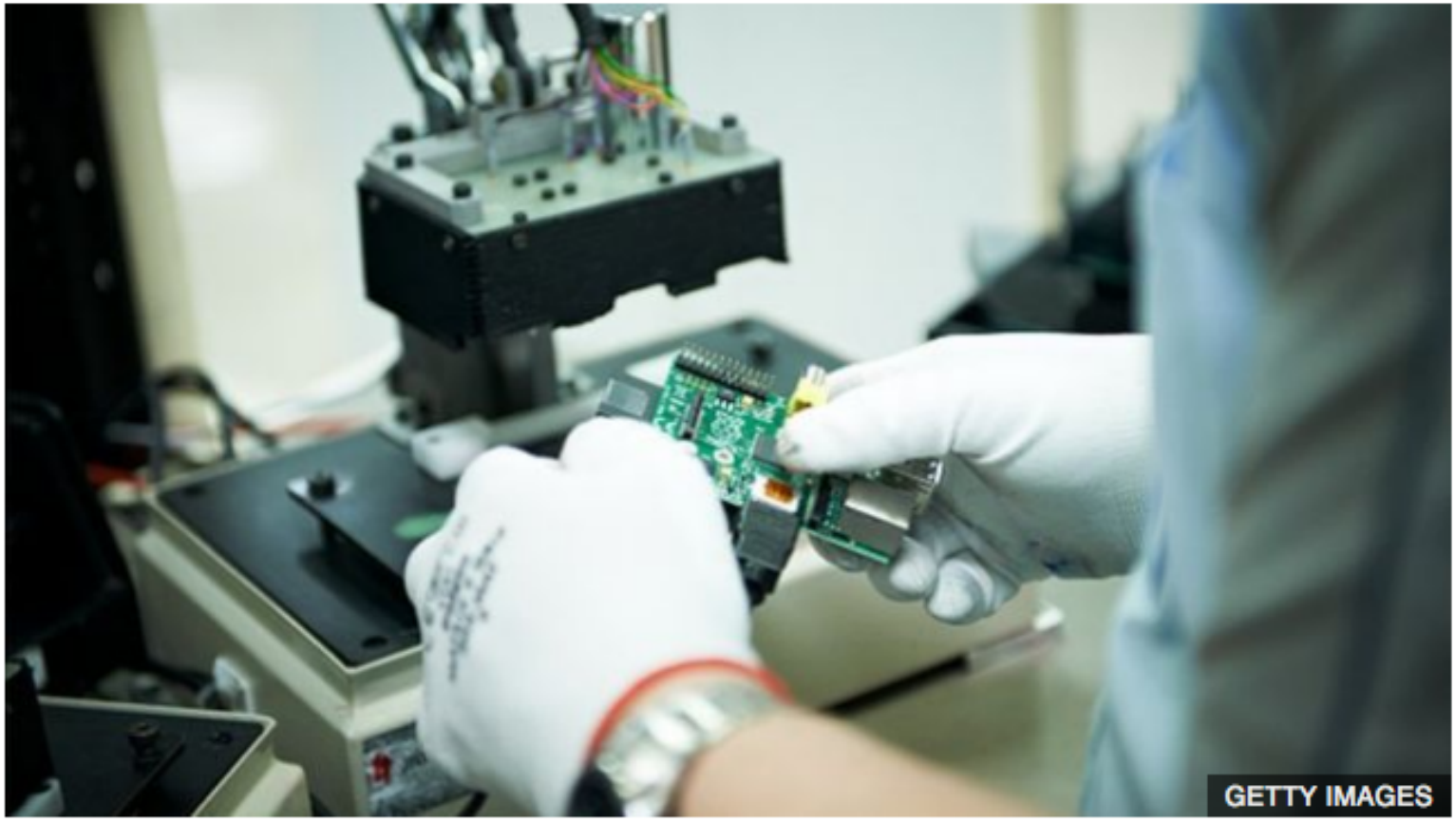
Digital Competence Framework

1. **Citizenship**
   - Identify, Image & Reputation
   - Health & Wellbeing
   - Digital Rights, Licensing & Ownership
   - Online Behaviour & Cyberbulling
2. **Interacting & Collaborating**
   - Communication
   - Collaboration
   - Storing & Sharing
3. **Producing**
   - Planning, Sourcing & Searching
   - Creating
   - Evaluating & Improving
4. **Data & Computational Thinking**
   - Problem Solving & Modelling
   - Data & Information Literacy

£4m to improve school results in science and technology

7 January 2017 | Wales politics

Share



More than £4m will be spent to raise standards in science and technology in Welsh schools.

Now...

- *Third year* of new Computing curriculum in England
- UK-wide – and international – curricula reforms

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- ...on multiple levels: schools, teachers, government, parents, public...

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- A community of practice: *CAS Network of Teaching Excellence*
- Moving from policy (*strategic*) to implementation (*operational*)
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- It's not just about tech...
- It's not just about coding...
- **Computing and CT is for everyone**

Looking Ahead...

- **Our work is not finished**

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- CPD and upskilling the teachers
- Building confidence and capability
- Recruiting (and retaining) qualified teachers

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- Depth, breadth and creativity

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- **The CAS motto:** *"There is no 'them', only us!*

Useful Links

- Join CAS! `http://community.computingatschool.org.uk`
- CAS Network of Excellence:
  `https://www.computingatschool.org.uk/noe`
- Computing Programme of Study in England (2013):
  `https://www.gov.uk/government/publications/national-curriculum-in-england-computing-programmes-of-study`
- Digital Competence Framework in Wales (2016):
  `http://learning.gov.wales/resources/browse-all/digital-competence-framework/?lang=en`
- *Hello World* magazine (by Raspberry Pi, CAS, BCS and BT):
  `https://helloworld.raspberrypi.org`
- Royal Society Computing Education project (2016-present):
  `https://royalsociety.org/topics-policy/projects/computing-education`

Policy Reports

- Nesta *Next Gen.* report (2011):
  `http://www.nesta.org.uk/publications/assets/features/next_gen`
- Royal Society report on Computing in Schools (2012):
  `http://royalsociety.org/education/policy/computing-in-schools/report/`
- UK Digital Skills Taskforce (2014):
  `http://www.ukdigitalskills.com`
- House of Lords Digital Skills Select Committee report (2015):
  `https://www.parliament.uk/business/committees/committees-a-z/lords-select/digital-skills-committee/news/report-published`
- House of Commons S&T Select Committee report (2016):
  `https://www.publications.parliament.uk/pa/cm201617/cmselect/cmsctech/270/27002.htm`
- House of Lords Communications Select Committee report (2017):
  `https://www.publications.parliament.uk/pa/ld201617/ldselect/ldcomuni/130/13002.htm`

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