COMPUTING AT SCHOOL
EDUCATE · ENGAGE · ENCOURAGE
In collaboration with BCS, The Chartered Institute for IT

The dream of a lifetime

Shaping how our children learn computing

Simon Peyton Jones,
Microsoft Research and Computing at School

Department for Education

Computing Age 6-16

Programmes of study for Key Stages 1-4

Aims

The National Curriculum for computing aims to ensure that all pupils:

- can understand and apply the fundamental principles of computer science, including logic, algorithms, data representation, and communication
- 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.

Informatics education:

Europe cannot afford to miss the boat

Report of the joint
Informatics Europe & ACM Europe Working Group
on Informatics Education
April 2013

Informatics Europe:
Walter Gander (chair), ETH Zurich, Switzerland
Antoine Petit, Inria & ENS Cachan, France

THE ROYAL SOCIETY

Education | Research & policy | Partnership Grants | Associate Sch

Computing in Schools
Shut down or restart?

Teaching computer science in France

Tomorrow can't wait

Report of the
Académie des Sciences
(French Academy of Sciences)

May 2013

CEPIS
Council of European Professional
Informatics Societies

Computing in Schools

A Call for Action from Informatics Societies

What we want

"Education should prepare young people
for jobs that do not yet exist,
using technologies that have not yet been invented,
to solve problems of which we are not yet aware."

Richard Riley

Disciplines

Skills

Disciplines

Ideas, knowledge, principles, techniques, methods

Maths, science, history, English

Skills

Artefacts, devices, programs, products, organisations, business

Presentation skills, metalwork, textiles, food technology, teamwork

Computer Science

ICT

Information and Communication Technology

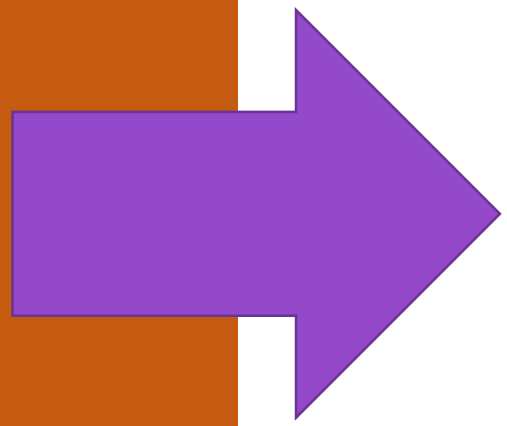
Spreadsheets, databases, Powerpoint, web, internet, audio, video, e-safety

This was the situation in the UK during the 2000's

Too much focus on technology

Not enough on ideas

Technology
Read
Consume
Use
Magic



Ideas
Write
Create
Understand
Knowledge

Discipline

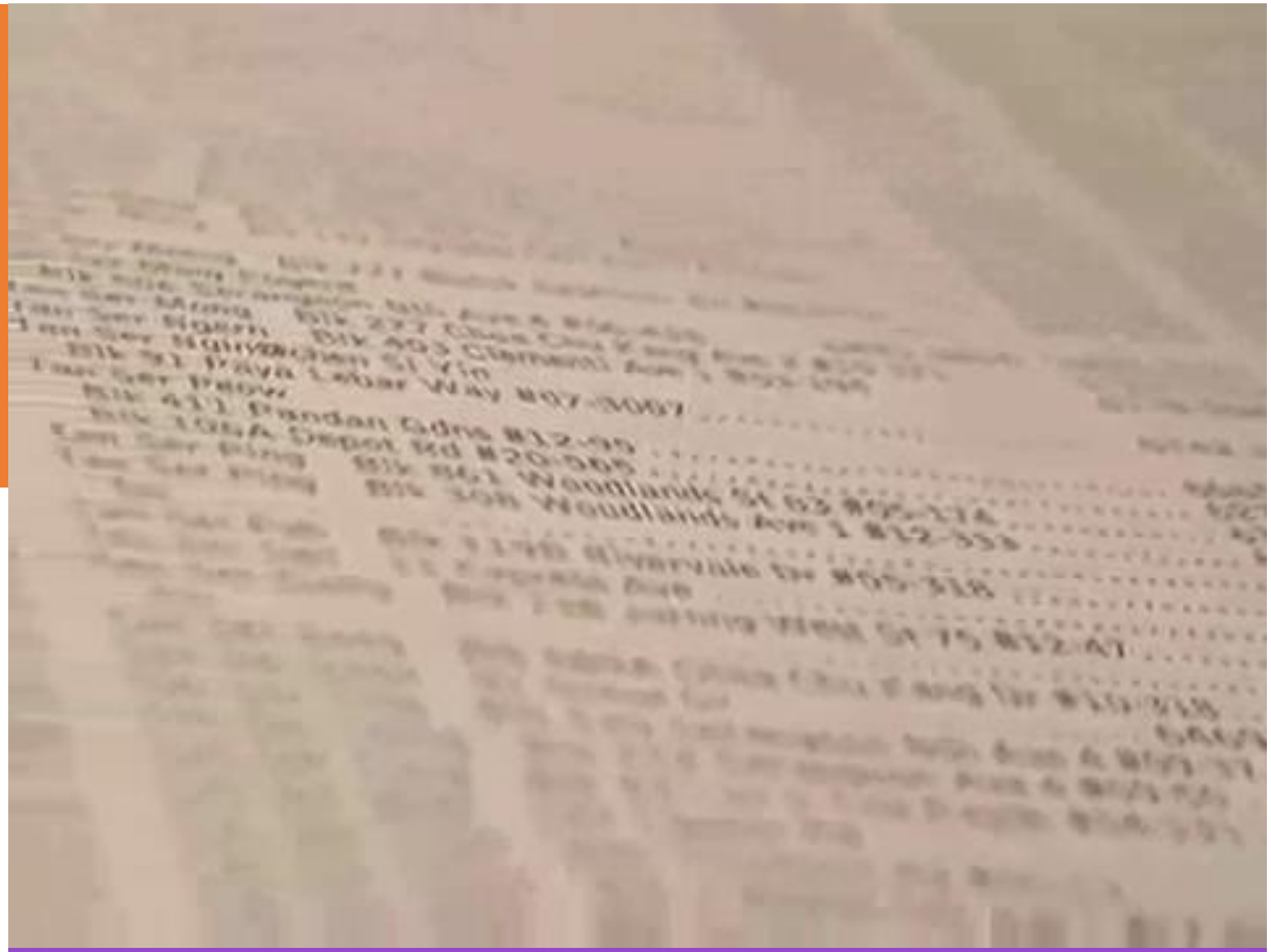
Computer science

So what goes here?

Skills

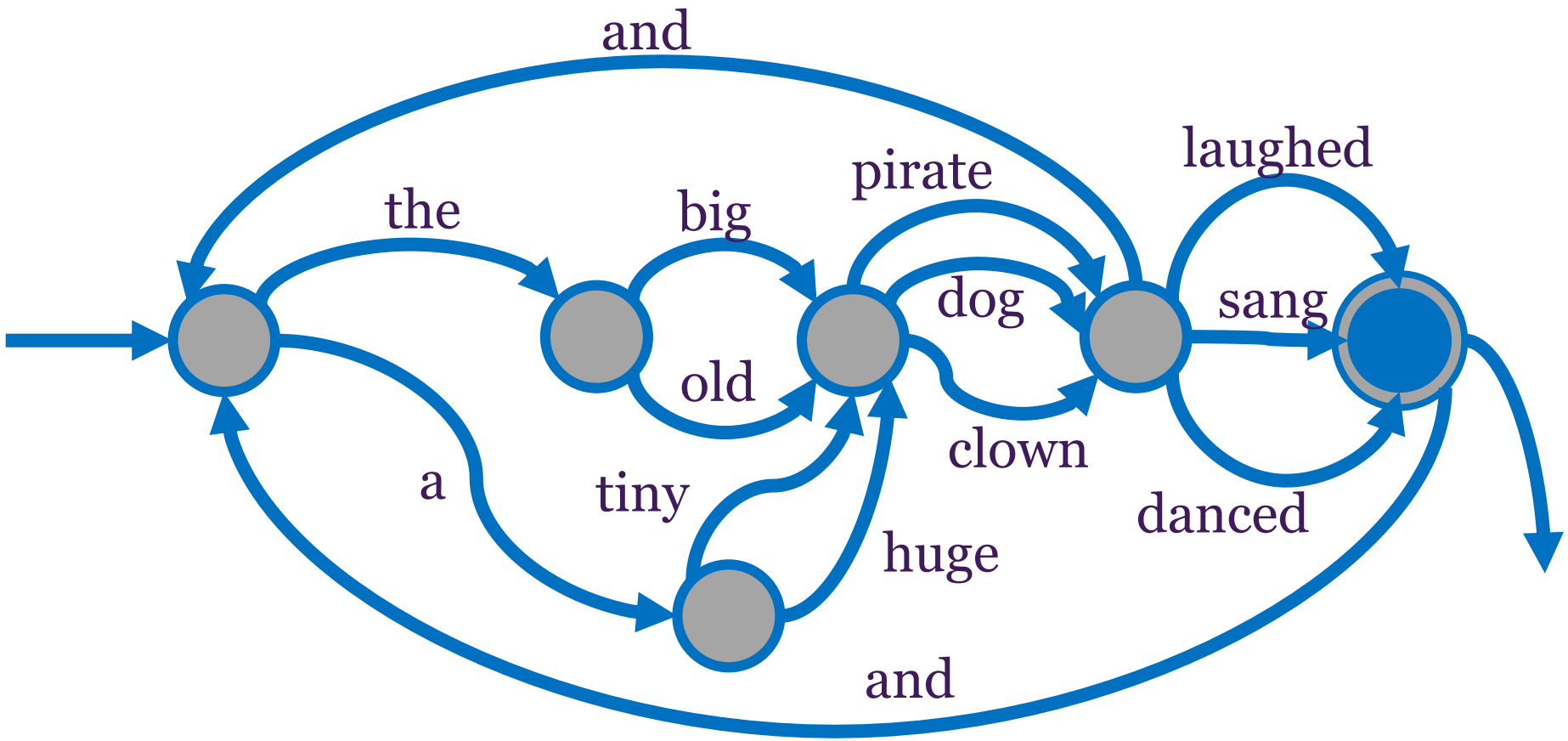
Digital skills

Look!
No computers



http://csunplugged.org/sorting-networks

Follow the arrows to generate a sentence



Vision

Computer science is a
foundational
subject discipline,
like maths and natural science,
that every child should learn
from primary school onwards

Careful positioning

- *Ideas*, not *technology*
  Not even primarily about computers
- *Every child*, not just geeks
- *Educational* not *instrumental*:
  Not just a vocational/economic imperative
- *Discipline*, not *skill*
  In particular, not just coding

Computational thinking (Jeannette Wing)

Computational thinking is the process of *recognising* aspects of information and computation in the world that surrounds us, and *applying* tools and techniques from computing to understand and reason about both natural and artificial systems and processes.

- Computational thinking is something **people** do, not something **computers** do
- Computational thinking is ubiquitous; it is useful in every profession, and in daily life

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Every child

- Understand the digital world
- Understand the natural world
- Gain skills for almost any job

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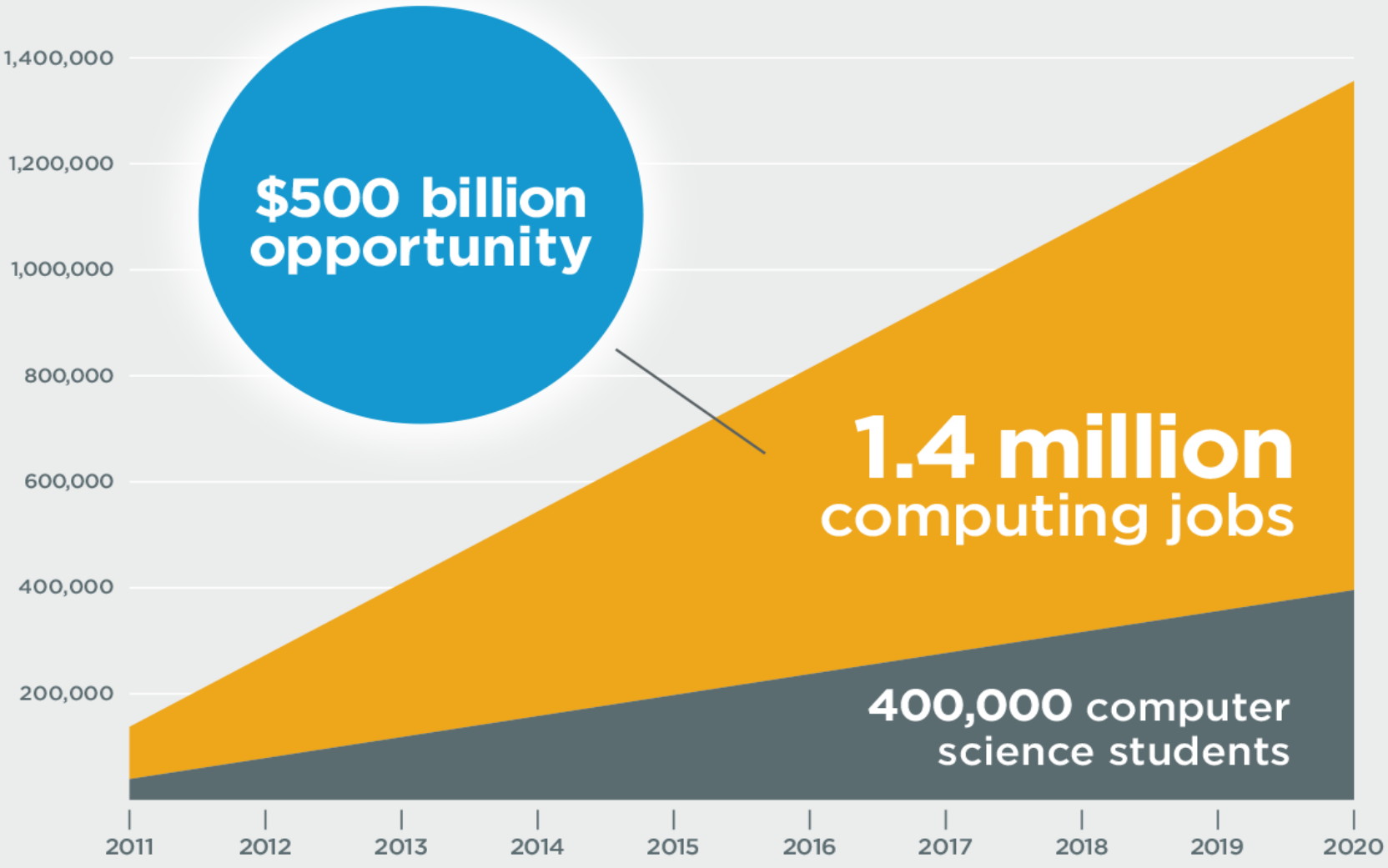
1,000,000 more jobs than students by 2020



Computer science **is a top paying college degree** and computer programming **jobs are growing at 2X the national average.**

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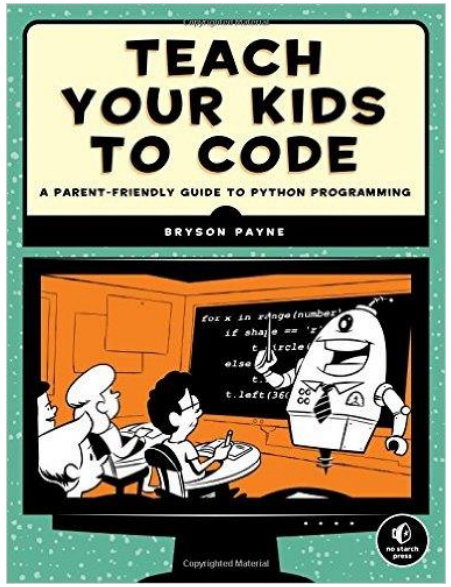
The Telegraph

Teaching our children to code: a quiet revolution

The next wave of the digital revolution arrives next year, with every child in the UK being taught computer programming. But is Britain ready?



Why Our Kids Must Learn to Code

Computer science and IT The Observer

Why all our kids should be taught how to code

15 Reasons Why We Should Be Teaching Our Kids To Code

BY JAYNE CLARE · APRIL 20, 2013 · BLOG · 13 COMMENTS

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The UK journey

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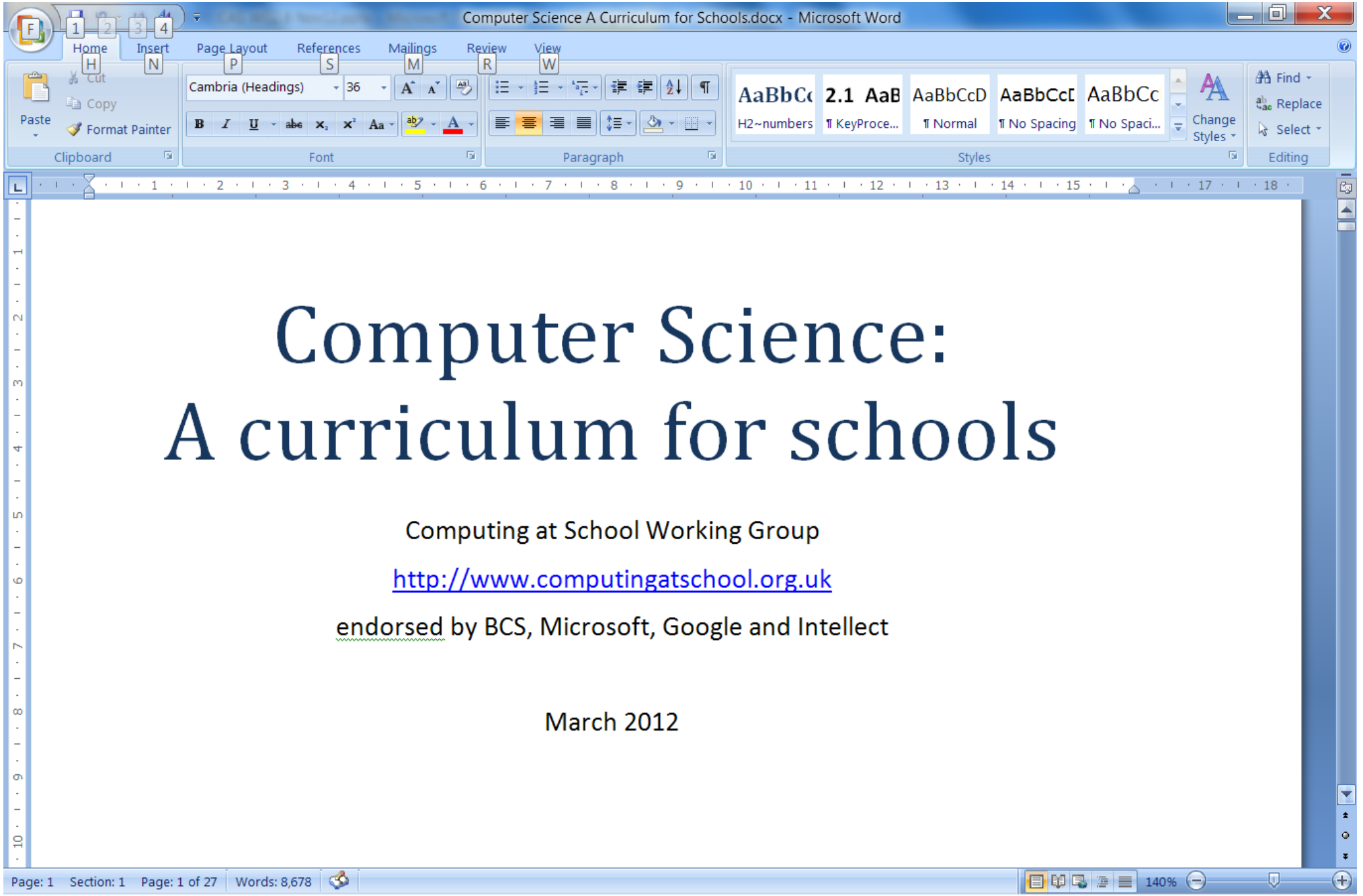
CAS is formed

CAS curriculum (35 pages)

2008 2009 2010 2011

2010


Computer Science A Curriculum for Schools.docx - Microsoft Word
Home
Insert
Page Layout
References
Mailings
Review
View
Cut
Copy
Format Painter
Paste
Cambria (Headings)
36
Clipboard
Font
Paragraph
Styles
Change Styles
Find
Replace
Select
Editing
Computer Science:
A curriculum for schools
Computing at School Working Group
http://www.computingatschool.org.uk
endorsed by BCS, Microsoft, Google and Intellect
March 2012
Page: 1
Section: 1
Page: 1 of 27
Words: 8,678
140%

Shut Down or Restart Report by Royal Society

Eric Schmidt (Google) tells us we should be educating our children in CS!

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2008 2009 2010 2011 2012 2013 2014

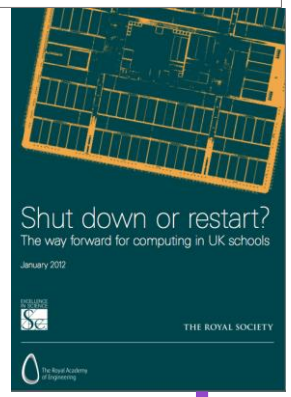
Review of the National Curriculum in England

Shut down or restart

- "The current delivery of Computing education in many UK schools is highly unsatisfactory"
- "Computer Science is a rigorous academic discipline and needs to be recognised as such in schools"
- "Every child should have the opportunity to learn Computing at school"

Shut Down or Restart Report by Royal Society

Eric Schmidt (Google) tells us we should be educating our children in CS!



BCS invited to create a working group to draft the new Computing curriculum

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In collaboration with BCS, The Chartered Institute for IT

CAS is formed

CAS curriculum (35 pages)

New curriculum (2 pages) published

New curriculum launches

2008 2009 2010 2011 2012 2013 2014

Review of the National Curriculum in England

Department for Education

Computing

Programmes of study for Key Stages 1-4

Starting Sept 2014 in England

Aims

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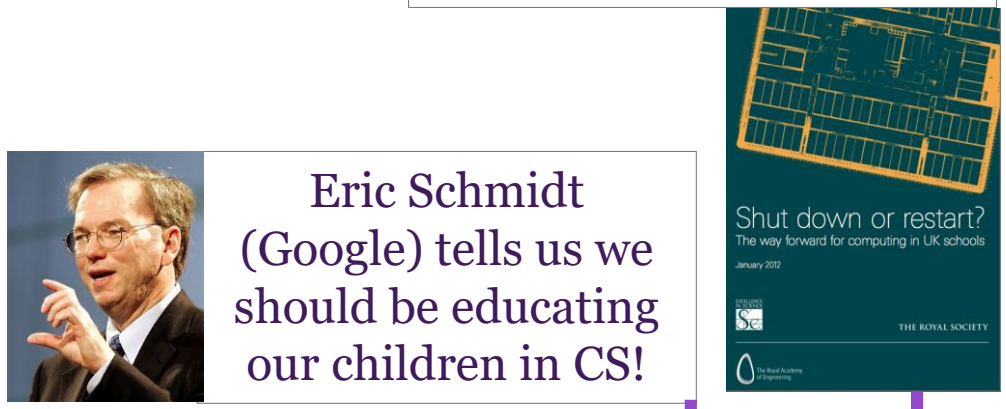
Shut Down or Restart Report by Royal Society



BCS invited to create a working group to draft the new Computing curriculum

None of this would have happened without CAS

Eric Schmidt (Google) tells us we should be educating our children in CS!

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Review of the National Curriculum in England

Lessons: what worked for us

- **A singular focus**: CS as a foundational subject
- **An educational message**, not just an instrumental one
- **A single voice**, not competing special interests
- **An independent, grass-roots group**, not an employers group, not a teachers group, not a higher-ed group
- **Support from professional bodies** (eg Royal Soc): influences civil servants
- **Support from industry leaders** (eg Eric Schmidt speech): influences politicians
- **Don't wait for policy change**: just get on with it
- **Luck**: the Review of the National Curriculum was hugely serendipitous

Opportunity and risk

Two national-scale experiments at once

1. Establish computer science as a brand new subject at school
2. Government explicitly standing back, inviting others to lead on implementation

3,500 secondary schools
17,000 primary schools
200,000+ teachers

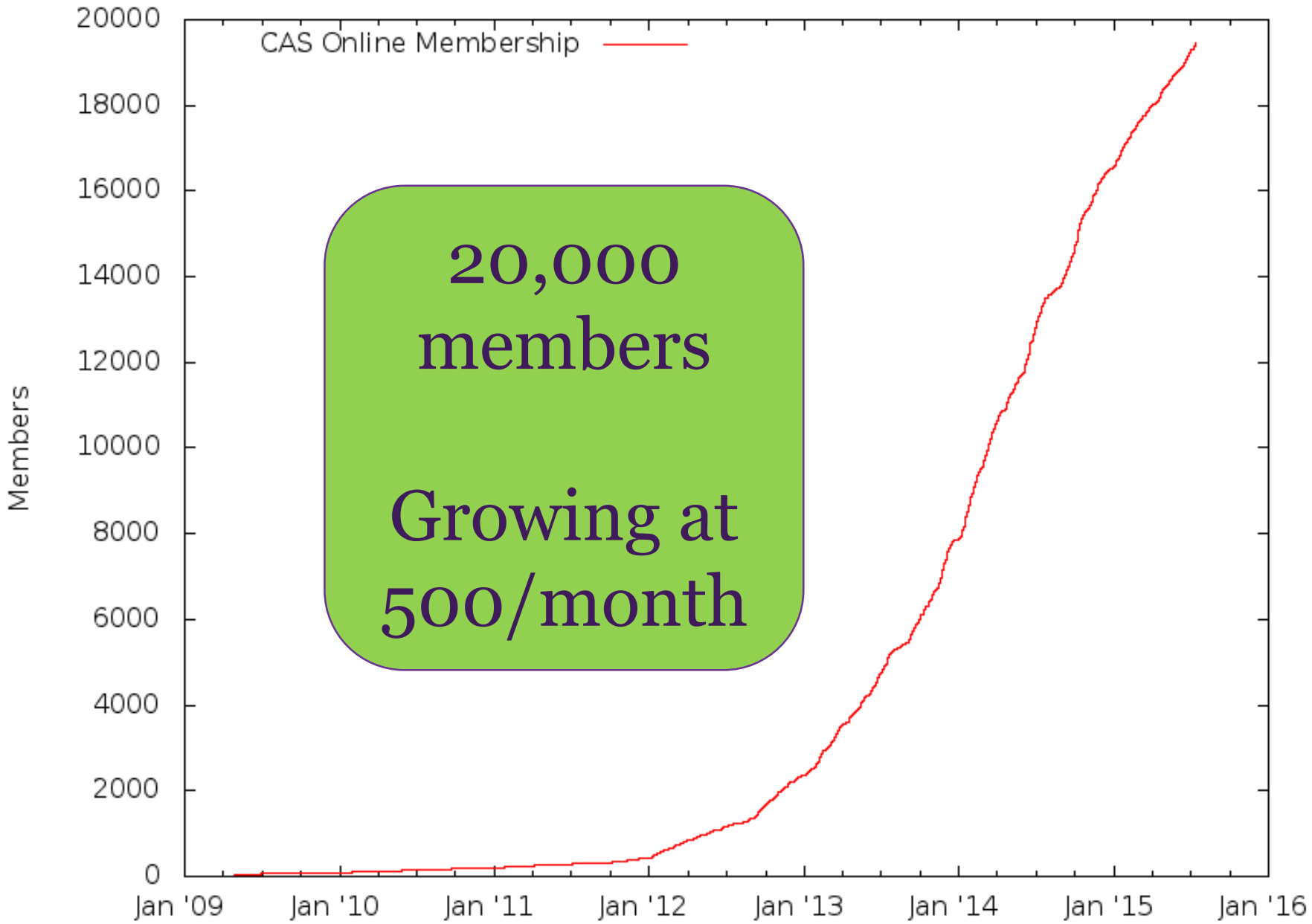
Virtually no qualified teachers

Teachers hungry for support

Computing at School

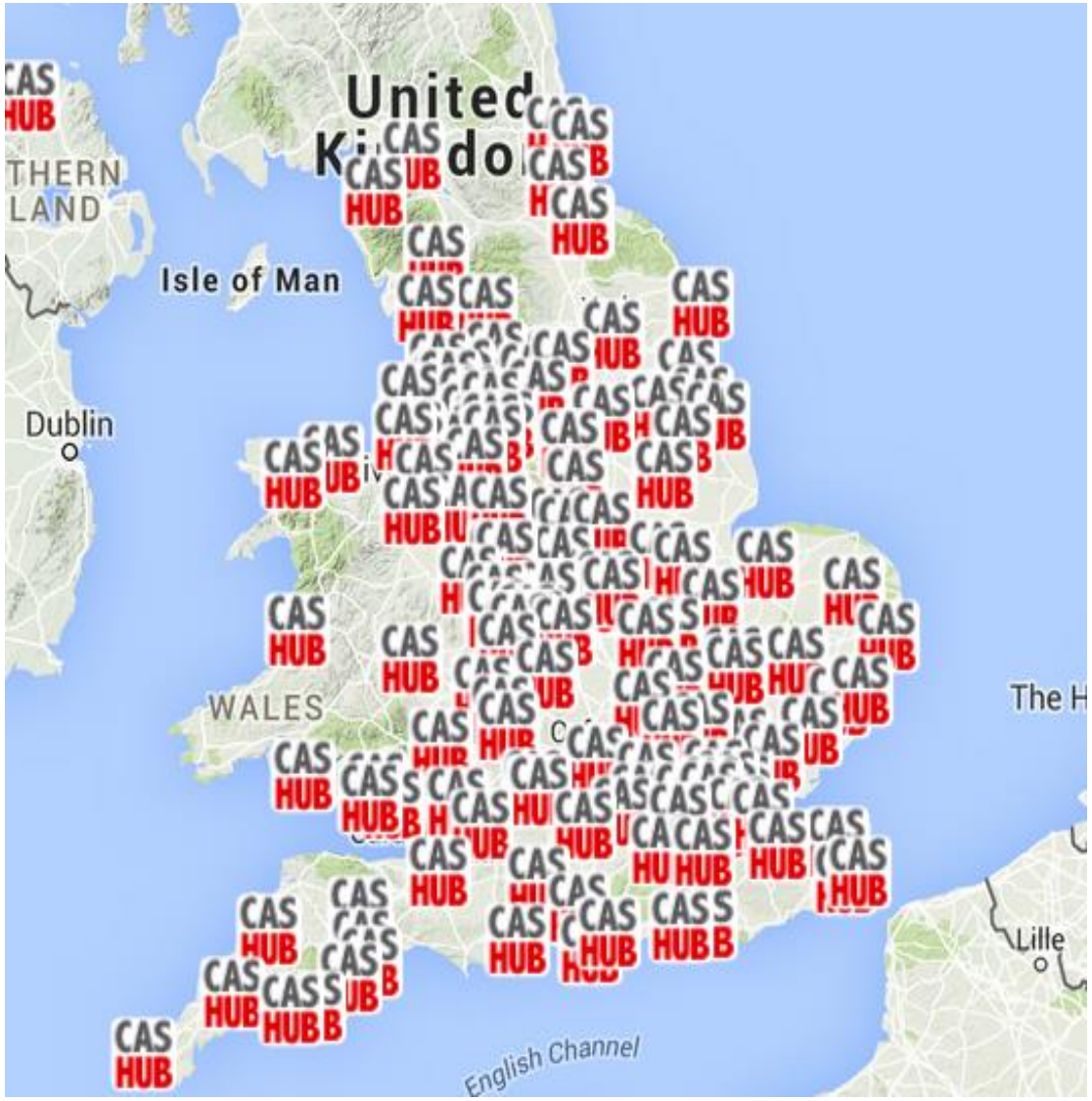
Computing at School launched (2007/8)

- **CAS is a vibrant grass roots movement:** teachers, professionals, academics..
- **CAS is a community of practice**, to support, encourage, equip, give vision to computing teachers
- **CAS is independent**: speaks for the subject, not for teachers, or academics, or companies, or govt.



- About 3/4 teachers, both primary and secondary
- But not all! Developers, IT professionals, parents…
- UK-centric, but open to international members

Loose, decentralised organisation



- Ten Regional Centres (based in universities)
- 89 universities
- 170+ Hubs
- 400+ Master Teachers
- 450 Lead Schools
- Masses of training events
- Amazing termly magazine
- Online community

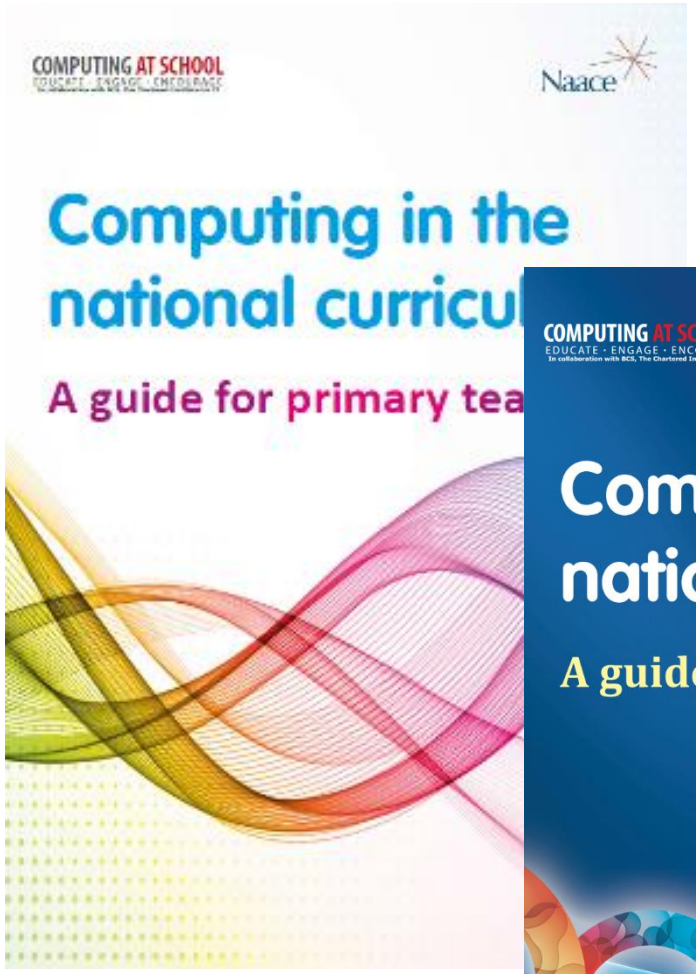
Partnership

- Now part of BCS
  - Credibility/legitimacy
  - Legal status
  - Good for BCS too
- Work in partnership with dozens of other groups of enthusiasts: Raspberry Pi, Code Club, code.org, cs4fn, Apps for Good, Sonic Pi, etc
- And publishers/suppliers: Codio, Codecademy, awarding organisations, Rising Stars, Hodder, etc

Funding

- DfE gives us our baseline funding, currently around £750k/yr.
  - Always vulnerable, but absolutely crucial
- Employers have been generous; typically project funding:
  - QuickStart (Microsoft)
  - Barefoot (BT)
  - Tenderfoot (Google)

Resources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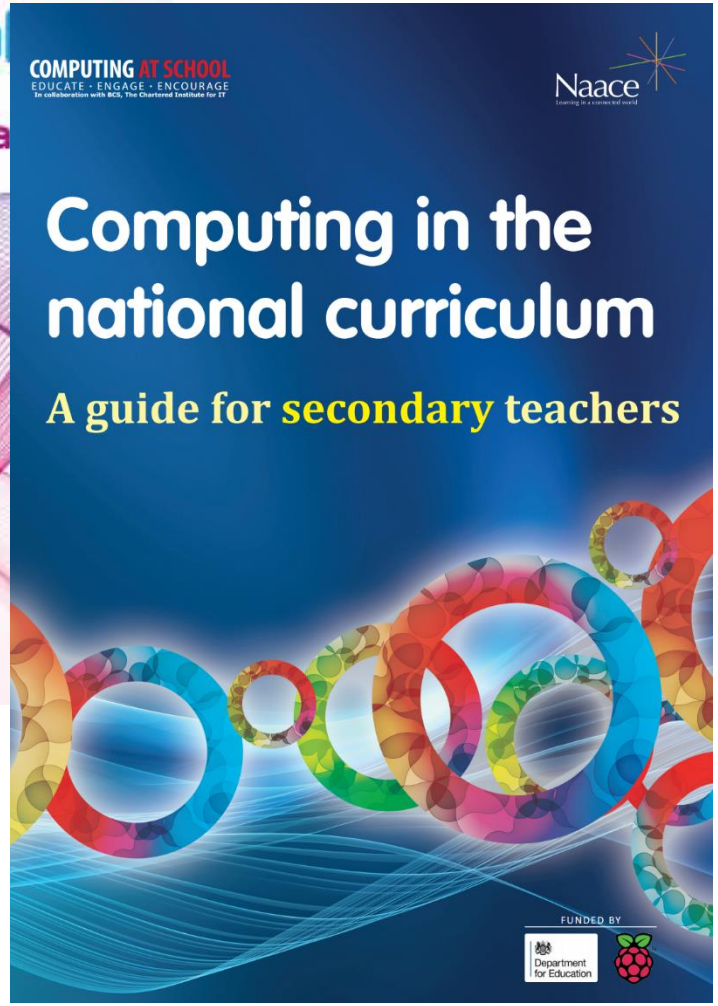
Computing in the national curricul
A guide for primary tea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FUNDED BY
Department for Education


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SWITCHEDON
COMPUTING AT SCHOOL NEWSLETTER
SUMMER 2014
COUNTDOWN TO COMPUTING
INSIDE THIS ISSUE


COMPUTING AT SCHOOL
QuickStart Computing
A CPD toolkit for primary teachers
COMPUTING AT SCHOOL
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oolkit for secondary teachers

Quickstart Computing

- Professional Development toolkit
- Help teachers figure out how to design, develop and deliver imaginative and creative computing in the classroom
- 40,000 packs went into schools
- 75,000 teachers trained, 60,000 more in-flight
- http://quickstartcomputing.org/

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QuickStart Computing

A CPD toolkit for primary teachers

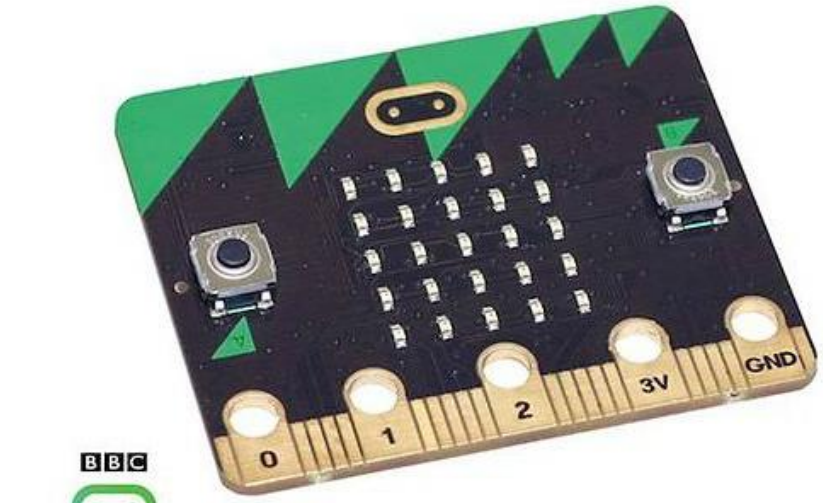
FUNDED BY

Department for Education

Microsoft

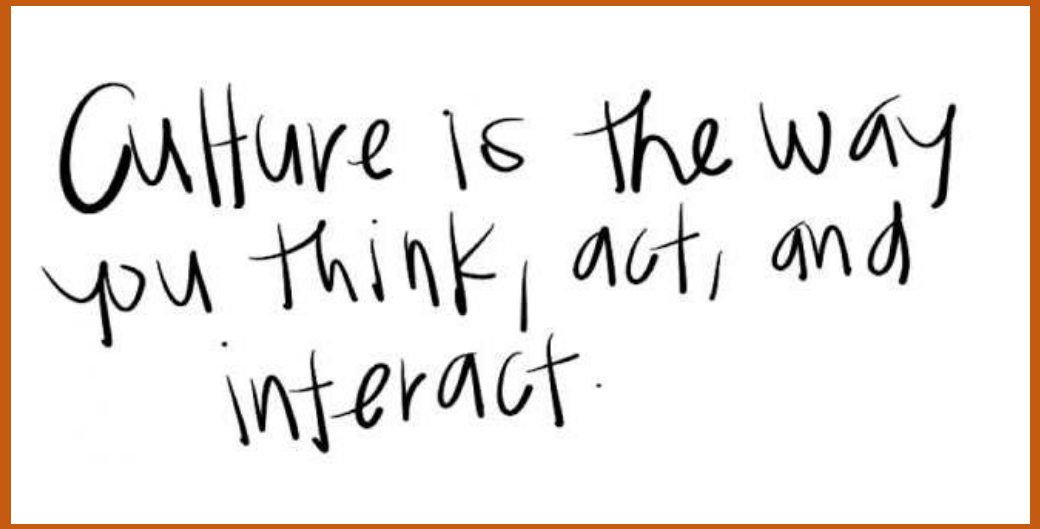
BBC micro:bit

- Vision: repeat the "BBC Micro" impact. From the classroom to the kitchen table
- A year-long campaign across all of BBC broadcasting
- LEDs, buttons, gyro, etc
- A million devices, one for each 12-year old
- Multi-employer partnership.
- My earnest hope: not just a one-year wonder



BBC micro:bit

Culture



- A community, not a service organisation
- Fundamentally grass roots; bottom-up not top-down
- Only two full time staff
- Think "open source community" and "gift economy“
- Passion, optimism
- There is no “them”; there is only us

Glue

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CAS Community

Resources / Discussions / Events

Network of Excellence | Simon Peyton Jones (Logout)

- Discussions
- Resources
- Events
- Members
- Master Teachers
- Hubs
- About
- Map

- Signup Codes
- Add Resource Category
- Post News
- Newsletters
- Hubs Admin
- NoE Admin
- Admin FAQ

Stats

Members: 20651
Resources: 3241
Hubs: 174

New last 30 days:

Latest activity

Gina Baker replied to the discussion Primary Scheme of work (7 authors - 7 replies).
3 minutes ago

vivienne ansah replied to the discussion A452 Linux (2014-2016) Teaching Resource (For Verified Teachers Only) (15 authors - 16 replies).
33 minutes ago

Ash Rahman replied to the discussion UK Bebras Challenge 2015 is now Open! (3 authors - 2 replies).
about 1 hour ago

Dominic Connor replied to the discussion What language(s) do you teach? (17 authors - 22 replies) and replied to the discussion The end of GCSE and A Level ICT Announced by DfE (64 authors - 204 replies).
about 1 hour ago

CAS Community added the event CAS Teesside Hub Meeting.
about 2 hours ago

Gary Barrows replied to the discussion OCR A452 Javascript task submit june 2017 (27 authors - 32 replies) and replied to the discussion AQA Population Model 2017 (11 authors - 28 replies).
about 2 hours ago

Dave Gibbs added the event Python Sheffield: micro:bit evening.
about 2 hours ago

Patricia Green replied to the discussion The end of GCSE and A Level ICT Announced by DfE (64 authors - 204 replies).
about 3 hours ago

News see all »

CAS Scotland Annual Conference 2015

CAS Scotland Annual Conference

Saturday 7th November 2015

University of Dundee

For the first time the CAS Scotland conference will have seminars, workshops and discussions that cover all levels of Computing education from Primary through Secondary and on into Further and Higher Education. So whether you're a lecturer, teacher or industry member with a strong interest in education there will be a wealth of interesting sessions just for you at Scotland's largest CS Education focused conference.

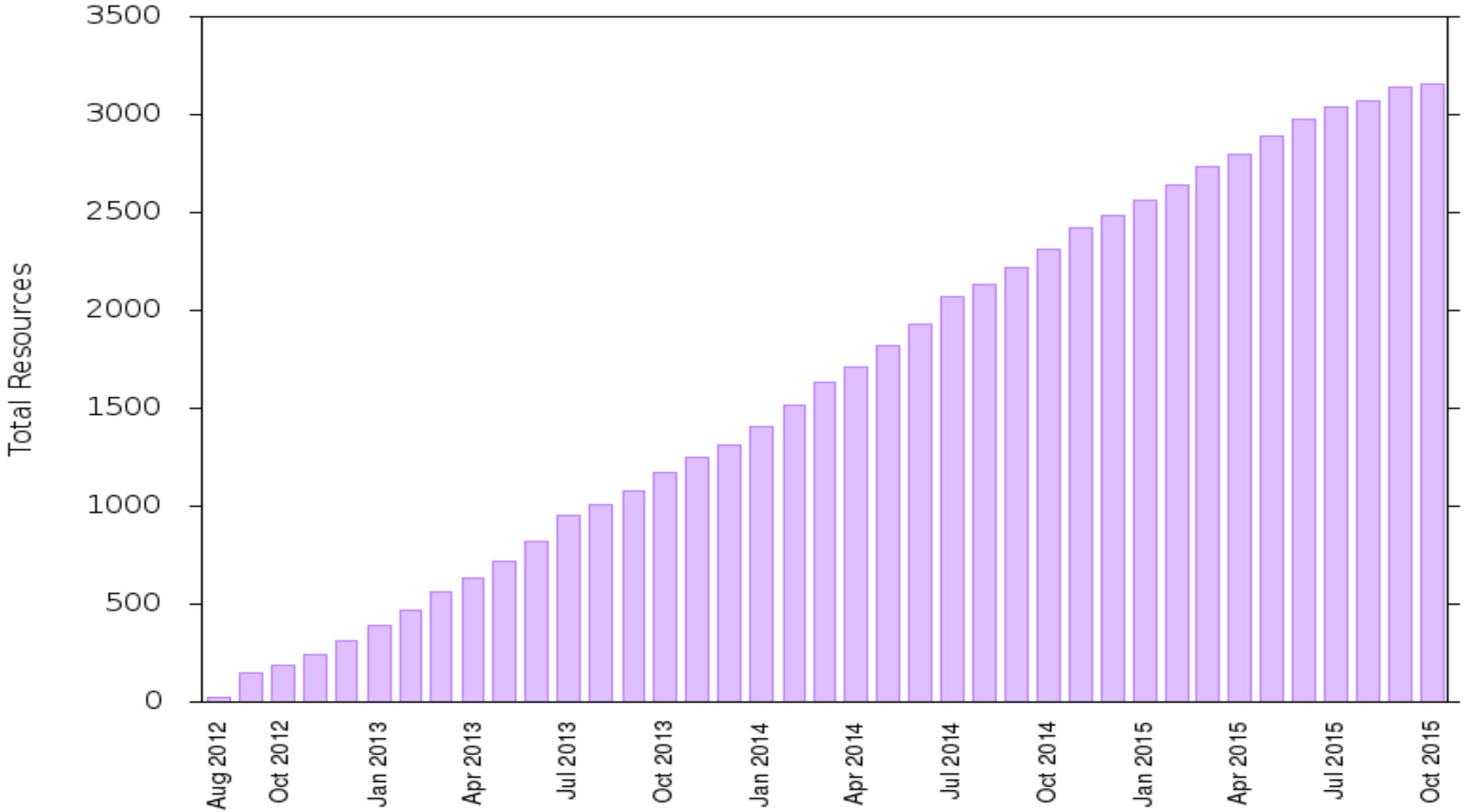
Our programme includes a wide diversity of topics including the latest developments in Eye Tracking research, Biometrics in Scratch, Minecraft, the BBC micro:bit, Cyber Security and even some Homesick Aliens so it's an event you won't want to miss!

Sign up and register for the conference here

Read more...

Encouraging participation and respect

- Site is designed to feel like a common room, not like a service station
- Front page shows recent conversations, not a form to search for resources
- Daily digest of clickable links
- Names, faces and places; a map shows where members, hubs, master teachers are
- Walled garden: no pupils!
- Like/Unhelpful buttons on posts; too many "unhelpful" clicks and the post is hidden
- Low barrier to entry for contributing resources


Total Resources
3500
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Aug 2012
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Apr 2013
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Jan 2014
Apr 2014
Jul 2014
Oct 2014
Jan 2015
Apr 2015
Jul 2015
Oct 2015

- You would think “someone must have studied this; there must be guidelines, examples, dos and don'ts” …but I have failed to find much
- Culture of respect is easy to lose, and hard to regain
- Curation, quality control vs the huge opportunity of the crowd eg StackOverflow.com

Lessons: what is working for us

- Don't wait for central intervention: just get on with it
- Inspire, equip, empower volunteers
- Spend most of the money at the leaves
- But seek project funding for targeted central interventions:
  - Develop excellent teaching materials
  - Develop excellent assessment [a very high-leverage opportunity]
- Challenges
  - Scale. SCALE.
  - Variation from place to place
  - Over-dependence on individuals.

Research questions

Evidence-driven reflection on the pedagody and assessment of computing at school

The opportunity

- **The laboratory**: thousands of teachers are teaching computer science and programming to hundreds of thousands of children.
- **The teachers** are eager but under-qualified; and hence unusually open to collaboration, partnership.
- **Low hanging fruit**, because so little study has happened in this area.
- Many questions….

Research context

What do we already know? Literature survey.

How can we make what we know accessible to teachers?

What can we apply from other subjects, or from generic edu research?

Programming

Programming as a vehicle for learning computational/informational thinking, rather than as an end in itself

What language?
For what purpose?

Scratch, Kodu, TouchDevelop, Greenfoot, Minecraft, Python, HTML, CSS, Javascript…

Debugging, explaining, predicting, not just writing code

The role of pseudocode (eg Haggis)

Pedagogy and assessment

Testing what we want students to learn,
not just what is easy to measure

Plugged vs unplugged?

How do you assess computational thinking?

Which concepts in which order for which age groups?

Discovery, or worked-out examples?

Resources

What do teachers need? In their perception? Is their perception "right"?

How to build on the cornucopia of resources that are already available? Quality control. Paths through the forest, quality control, review/feedback

Challenges: funding and capacity

Do you have evidence of strong proposals going un-funded? Liam Blackwell (EPSRC)

- Even if we had the funding , do we have the research capacity? How could we nurture/develop greater capacity?
- Need: a **spectrum of rigorous, well-articulated research proposals**
  - Variety of scale: fund a PhD student, do a 1-year study, … upwards …
- If they go un-funded, we can make a noise about it. Without the proposals, we can't.

Focus

- On *developmental* projects that *generate new ideas* (rather than arms-length RCTs)
- On *active engagement with teachers as co-researchers*, rather than as experimental subjects.
- On *how to embody the "big vision" of the new curriculum* (CS as a foundational subject) rather that a narrow focus on programming.
- On *assessment* as well as on pedagogy
- This is an international issue

Non-focus

- New programming languages or programming environments for teaching kids to code

Is all this important?

- If we do nothing, *something* will happen anyway. But probably not something good
- Individual teachers, companies, and even government, are not going to address these questions.
- Only researchers can.

Engaged, curious

Empowered, informed

Creative, playful

Employed

Key links collected here

http://community.computingatschool.org.uk/resources/3084