

The dream of a lifetime  
Shaping how our  
children learn computing

Simon Peyton Jones, Microsoft Research



A photograph showing a teacher and several students in a classroom. The teacher, a woman with short brown hair, is leaning over a student's shoulder, pointing at a computer screen. The student, a young girl with short brown hair, is looking at the screen. In the background, another student is visible, smiling. The scene suggests a collaborative learning environment.

# What is education for?

“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

What has happened  
in practice?

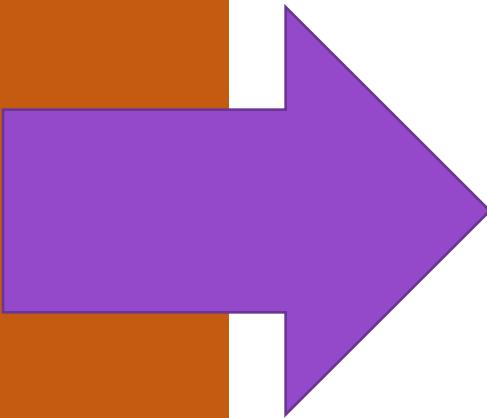
# Information and Communication Technology

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

Too much focus  
on technology

Not enough on ideas

Technology  
Read  
Consume  
Use  
Magic



Ideas  
Write  
Create  
Understand  
Knowledge

# Mission

Establish computer science  
as a foundational subject,  
that every child should learn,  
from primary school onwards





# Articulate the vision

# What is Computer Science?

# What is Computer Science?

Algorithms + data structures = programs

Computation + information = computer science

# Computational thinking (Jeannette Wing)

Computational thinking is the process of *recognising* aspects of 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.

Don't forget  
"informational  
thinking" too

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

Look!  
No computers

# Video

<http://csunplugged.org/sorting-networks>

Follow the arrows to generate a sentence

and

the

big

pirate

laughed

a

tiny

dog

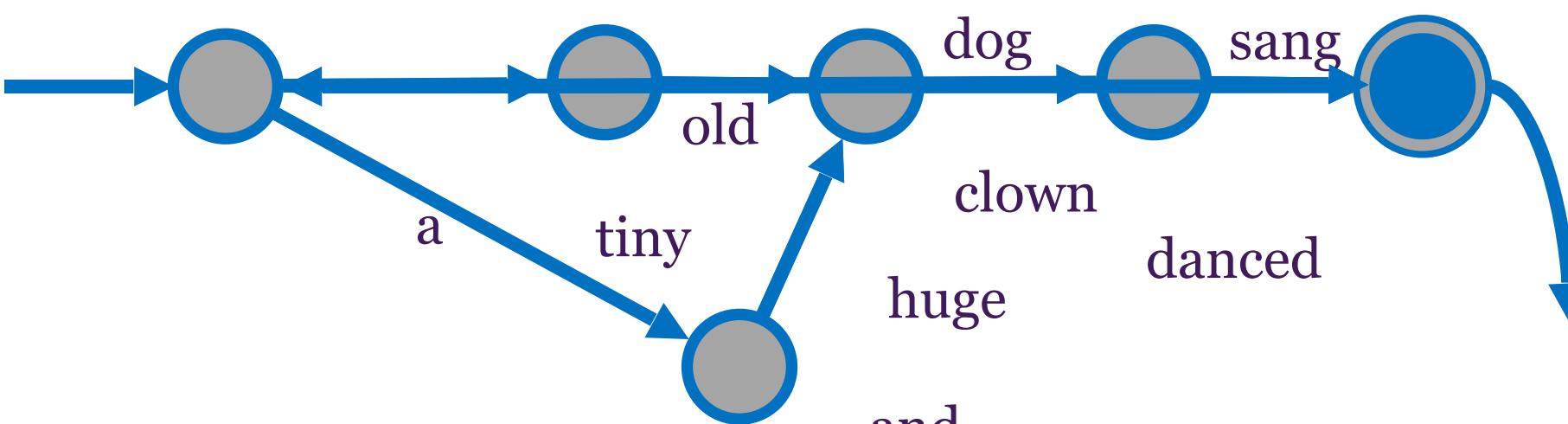
sang

clown

danced

huge

and



Programming

Computer science  
(discipline)

$\neq$

Programming  
(craft, skill)

Features | Reportage | Arts | Reviews | Plus David Mitchell and 7-day TV listings

The Observer

# THE NEW REVIEW

SUNDAY APRIL 2012

[msg, 'lemon', 'kale', 'joker'] make do  
pops, "R{zom} is awesome!"  
mrs.

Clip  
Mobile Coder  
Fancy new [f]riend  
I had no [c]oncept  
M11's and [d]ebugging  
idea "and there"  
John [  
darker] "the next time  
you're in [t]rouble"



# WE NEED TO TEACH OUR KIDS TO CODE

A MANIFESTO

John Naughton on why it's time to  
rethink how we teach computing



Observer  
1 April 2012

Programming

Programming  
*incarnates*  
computer science

Why  
Computer  
Science for  
*every*  
child?



# Why?

- Understand the digital world
- Understand the natural world
- Skills for almost any job



# Summary so far

1. Computer science is **educationally foundational**
2. Computer science equips students to meet the **huge un-met demand** from employers.
3. Computer science is **tremendous fun**: creativity, intellectual beauty, programming, robots, making things do stuff.

What more do you want?

# Which leaves the problem





Engage the  
Policy makers

2010

Computer Science A Curriculum for Schools.docx - Microsoft Word

The screenshot shows the Microsoft Word 2010 ribbon interface. The Home tab is selected. The Font group shows Cambria (Headings) at size 36. The Paragraph group shows a list-style icon. The Styles group shows several styles: AaBbCc, 2.1 AaB, AaBbCcD, AaBbCcT, AaBbCc, H2~numbers, 1 KeyProce..., 1 Normal, 1 No Spacing, 1 No Spaci..., and Change Styles. The ribbon also includes sections for Page Layout, References, Mailings, Review, and View. The main content area displays the title 'Computer Science: A curriculum for schools' in a large, bold, dark blue font. Below the title, the text 'Computing at School Working Group' is centered, followed by the website 'http://www.computingatschool.org.uk'. Underneath that, the text 'endorsed by BCS, Microsoft, Google and Intellect' is also centered. The status bar at the bottom shows 'Page: 1 Section: 1 Page: 1 of 27 Words: 8,678' and a zoom level of '140%'. The left margin has a ruler scale from 1 to 10 cm.

# 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%

# 2011/2: High profile reports

- Feb 2011: The Livingstone/Hope report
  - Bring computer science into the National Curriculum as an essential discipline
- 2011: Ofsted report on ICT
- Jan 2012: Royal Society Computing in Schools Report
  - 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



# 2011: Into political discourse



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

*Eric Schmidt, CEO Google,  
August 2011*

# Qualifications

	Awarding bodies	Number of GCSEs in Computer Science
<i>Sept 2009</i>		0
Sept 2010	OCR	1
<i>Sept 2012</i>	<i>AQA, Edexcel</i>	4
Sept 2013	CIE	5

# New dirt-cheap hardware platforms



.NET Gadgeteer Infrared Remote Control

FEZ Spider LED Array helicopter

Raspberry Pi computer: Can it get kids into code?

By Julian Joyce  
BBC News

BBC Mobile NEWS TECHNOLOGY

29 February 2012 Last updated at 07:59

829 Share

A screenshot of a BBC News mobile website article. The main headline is "Raspberry Pi computer: Can it get kids into code?". Below the headline is a sub-headline "FEZ Spider LED Array helicopter". The article is by Julian Joyce from BBC News and was published on 29 February 2012. The BBC News logo and navigation links like Home, World, UK, England, N. Ireland, Scotland, Wales, Business, Politics, Health, and Education are visible. A photo of a hand holding a Raspberry Pi board is shown at the bottom of the article.

2011-4

## **Review of the National Curriculum in England**

culminating in...



# Computing

Starting Sept 2014  
in England

## 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.







# Making it Happen

# New, foundational subject



Training teachers

Pedagogy

Materials

Assessment

Qualifications



# Who will do all this?



Not the  
Department for Education



We will!

A  
once-in-a-generation  
opportunity...

...for all of us:  
companies  
computer scientists  
educational folk  
software professionals  
all of us...

...to shape what  
the subject we know best  
means in practice...

...for the children we love...

...and the rest of the world

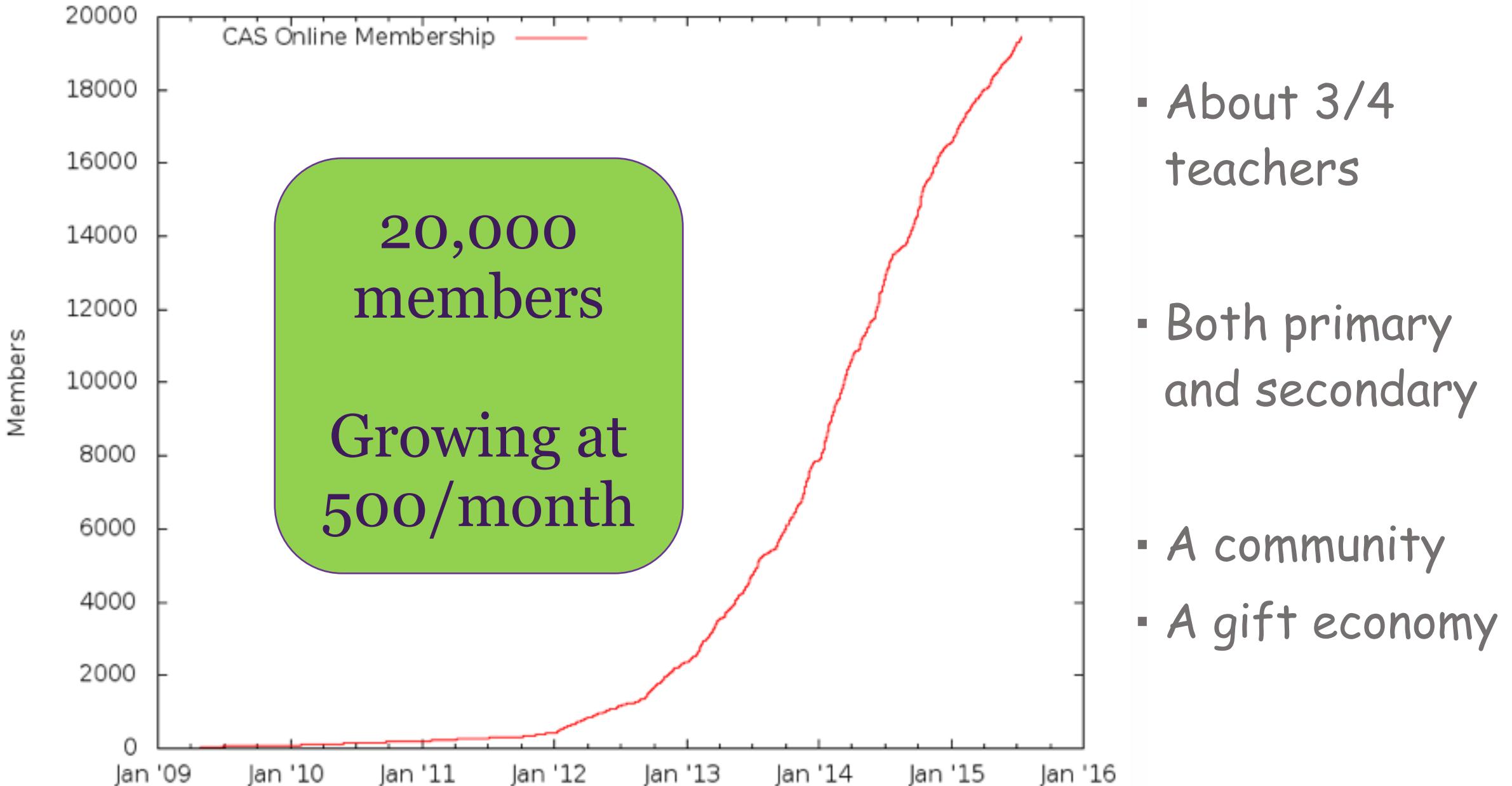
England is first out of the gate  
Everyone else is watching

# COMPUTING AT SCHOOL

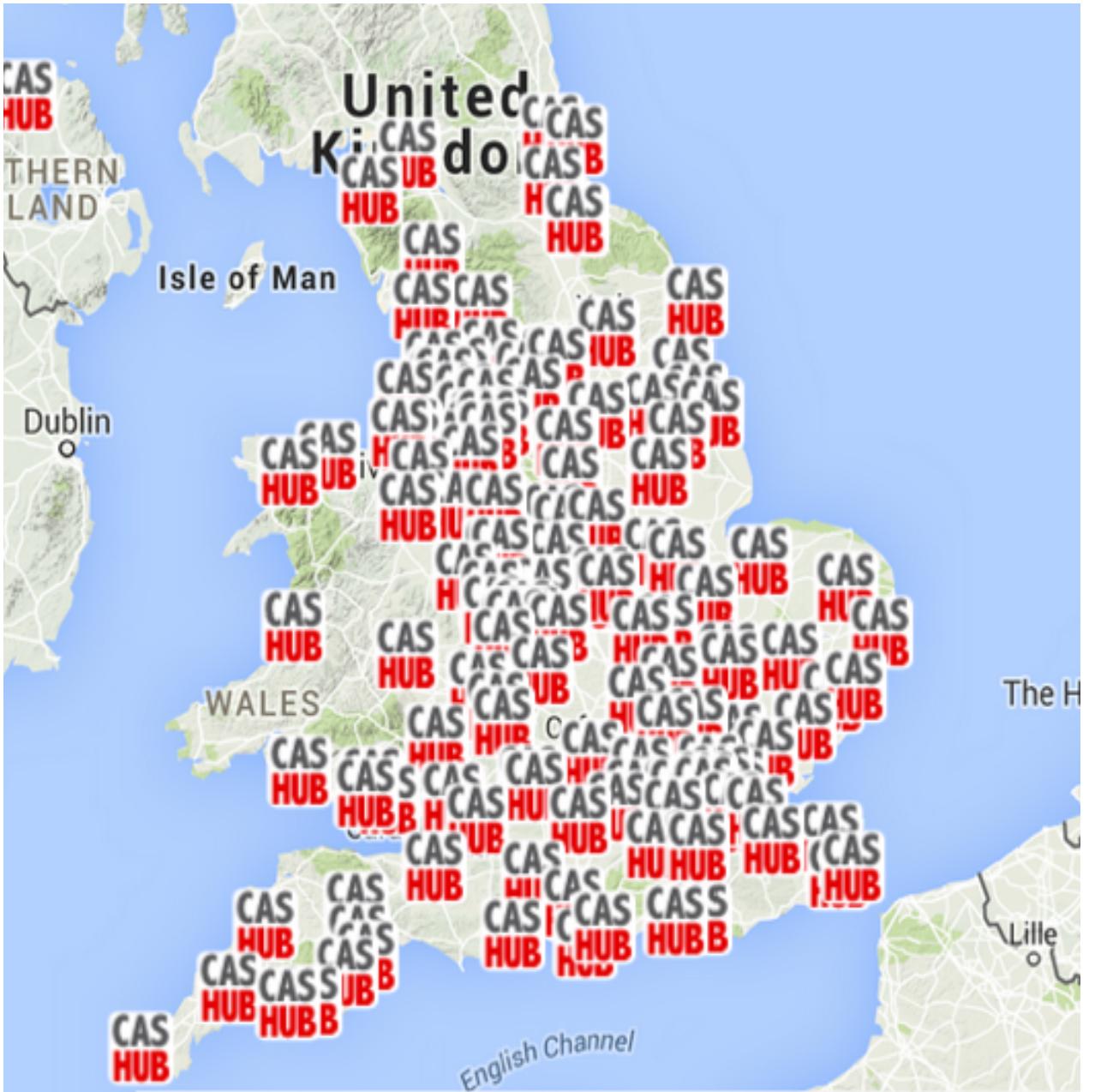
EDUCATE · ENGAGE · ENCOURAGE

Part of BCS –The Chartered Institute for IT

- Simply a group of individuals, concerned about the state of computing education at school in the UK
- Varied backgrounds, common concerns
  - Teachers
  - Industry (eg Google, Microsoft)
  - University academics (incl CPHC, UKCRC)
  - Members of exam board (eg AQA)
  - Members of professional societies (eg BCS)
  - Parents
  - Local educational advisers
  - Teacher trainers
- Virtually no staff, no money, no office. All volunteers



# 163 Hubs



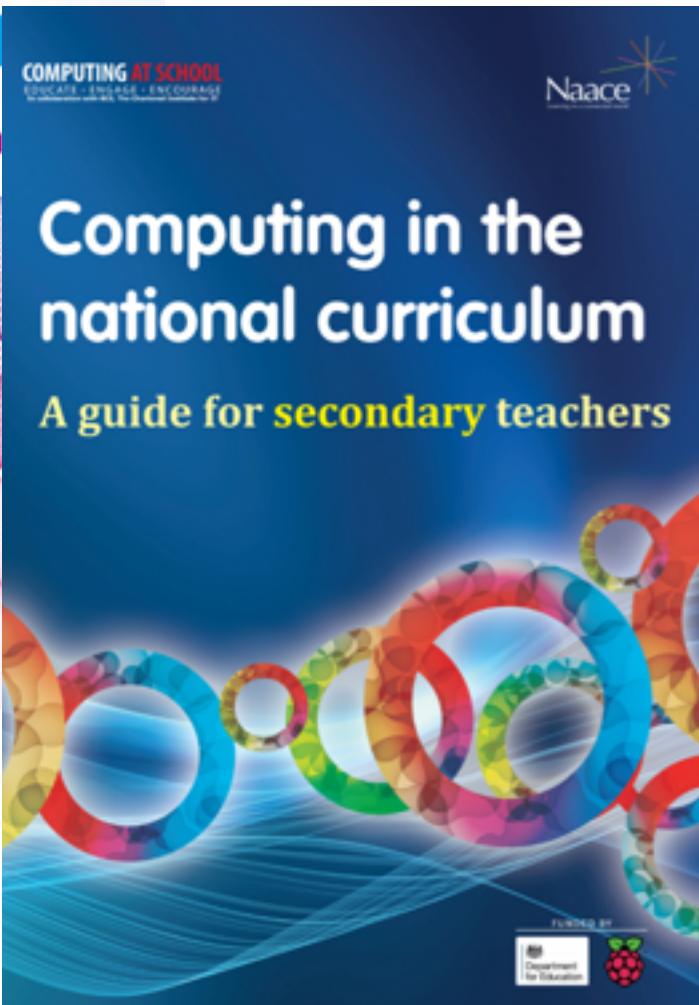
# CPD and the Network of Excellence

- Massive challenge
  - 250,000 primary teachers
  - 20,000 secondary teachers
- Computing at School (CAS) and the British Computer Society (BCS) have launched a national **Network of Excellence for Teaching Computer Science**
- 800+ schools signed up
- Single goal: support and equip our teachers to teach Computing
- Modest DfE funding



## Computing in the national curriculum

A guide for primary teachers



# Resources

In collaboration with ACPD, The Chartered Institute for IT

## SWITCHED ON

COMPUTING AT SCHOOL NEWSLETTER



SUMMER 2014

## COUNTDOWN TO COMPUTING

INSIDE THIS ISSUE

The summer term and teachers everywhere turn their attention to planning for September. Curriculum design is the central theme running through this issue. If need not be daunting, CAS CPD co-ordinator, Mark Dalling, looks

This September, a new National Curriculum tailored for all key stages comes to life. Computing. This historic change, the largest since the National Curriculum was conceived over twenty five years ago.



COMPUTING AT SCHOOL  
EDUCATE - ENGAGE - ENCOURAGE

QuickStart Computing

ACPD toolkit for primary teachers

QuickStart Computing

ACPD toolkit for secondary teachers

# Our friends... we love you

Cambridge  
Hacklab

Apps for  
Good

Raspberry Pi

Hack to the  
future

Sonic  
Pi

Young  
Rewired  
State

Greenfoot

cs4fn

YouSrc

Computing  
at  
School

CoderDojo

Codio

Technocamps

Code  
Club

Codecademy

Make Things  
Do Stuff

NextGen  
skills  
campaign



PPIG!  
Your country  
needs you!

# Two challenges

Scale

Evidence-driven reflection



# Programming

What language? For what purpose?

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

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

Debugging,  
explaining,  
predicting, not  
just writing  
code

# Pedagogy and assessment

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

Plugged vs unplugged?

Which concepts in which order for which age groups?

Discovery, or worked-out examples?

# Practical steps



Join CAS  
Go to a CAS Hub  
Partner with a teacher  
Be a cs4fn speaker  
Run a Code Club  
Write a research proposal

This is our moment  
It won't come again

Engaged,  
curious

Empowered,  
informed



Creative,  
playful

Employed