Computing education – 1 year on

Royal Society

Digital Skills Partnership
Computing in Schools Delivery Group

Co-Chairs

Sarah Foxall – Corporate Affairs, Microsoft

Rosalind Mist – Head of Policy, Education, Royal Society
The problem:

Many individuals and organisations do not have the digital skills required to take advantage of the benefits the internet offers.

This can have a stifling effect on, for example:

- Economic productivity and growth
- Career opportunities and earning potential
- Increased social inclusion
- Better health and welfare
Some causes:

• Fragmented, incoherent landscape of digital skills provision
• Lack of demand or motivation to take up training
The challenge:
To increase digital skills at all levels of capability

- 4.3 million UK adults with no basic digital skills
- Around 42 million with ‘general’ digital skills (limited data within this range)
- 7 million with 1 to 4 of the 5 basic digital skills
- 1.3 million in specialist roles that require advanced digital skills
## Digital Skills Partnership Board

<table>
<thead>
<tr>
<th>Delivery Groups</th>
<th>Digital Enterprise</th>
<th>Computing in schools</th>
<th>Local DSPs</th>
<th>National coherence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increasing motivation and digital capability among SMEs and charities</td>
<td>Increasing support from business for those teaching a world-leading computing curriculum</td>
<td>Supporting the development of local partnerships which address the digital skills needs of local communities and economies</td>
<td>Developing Diagnostics that help people to assess their capability</td>
</tr>
<tr>
<td>Peer-to-peer frameworks for charities &amp; SMEs</td>
<td>Developing guidance and support for businesses</td>
<td>Local DSP playbook Tools &amp; guidance to help other regions</td>
<td>Mapping provision Developing a data tool</td>
<td></td>
</tr>
</tbody>
</table>
Computing in Schools Delivery Group

Members

- Microsoft
- Cisco
- Department for Digital, Culture, Media & Sport
- BBC
- Amazon
- Apps for Good
- BCS (The Chartered Institute for IT)
- UKIE
- John Lewis & Partners
- micro:bit
- Google
- ARM
- Siemens
- National Cyber Security Centre
- Morgan Stanley
- BT
- PwC
- Tech UK
- Creative Assembly
- The Royal Society
Computing in Schools Delivery Group

The three objectives of the Delivery Group

- Understand the landscape of industry and non-profit support for computing, computer science and digital skills associated with schools and colleges, the strengths and weaknesses of this approach; identifying measurable impact and best practice.

- Inform the efforts of industry and non-profits in order to maximise the impact of the support industry and non-profits are providing for young people to learn computing in schools and colleges, and how industry, non-profits and government can work together more cohesively.

- Pay particular attention to addressing issues relating to girls and socio-economic disadvantage in relation to computing in schools.
Computing in Schools Delivery Group

Workstreams – H2 2018

“We will support schools to find the best matches for their needs, identify gaps, and improve the support on offer.”

Create Cohesion

Top Picks
Information highlighting selected sources of support for computing. Builds on work of Teacher and Student sub groups. Selections made by expert teachers, disseminate via Hello World.

Improve Quality

Conference & workshops
Convene a workshop for key providers of resources/initiatives, academics and experts, to review methods of measurement and evaluation of support for computing in schools. Create and promote a definition of good practice.

Drive Support

Campaign
Launch a campaign to generate more support for computing in schools from employers. Ask organisations to support school computing via pledges.

Vision: establish a self-sustaining source of information about resources and support for Computing in Schools, with a compelling user interface that helps teachers, students and supporters find the best matches for their needs, identify gaps in provision, and drive increases in coherence, quality and support.

Delivery Group H2 Goal: Develop a proposed data framework and platform outline, to share with Government and the NCCE.
After the Reboot

Professor Simon Peyton-Jones FRS
Background

- **2012**: the Royal Society published *Shut Down or Restart?*, a review of computing education in UK schools.
- **2014**: the DfE launched a new curriculum for computing, with computer science as a foundational discipline.
- **2017**: *After the Reboot* explores the state of play, three years into the new curriculum.
“Computer science is a foundational subject discipline, like maths and natural science, that every child should learn from primary school onwards.”

**Vision**

- Focus on *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.
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.
Challenges identified

- There is a lack of teacher confidence in teaching an unfamiliar subject without adequate support.
- There is a growing shortage of qualified computing teachers.
- The qualification landscape, especially at age 16, is a cause of real concern.
- Computing has a greater gender imbalance than any other subject.
- We need research to know how best to teach computing at school.
Key recommendations and progress made over the past year
Teacher confidence and supply

The challenge:

We are introducing an entirely new foundational subject discipline into the curriculum
Teachers are our heroes and heroines

One engaged, well-equipped, passionate teacher can inspire thousands of students.

Being a teacher is hard

Being a computing teacher is harder

• Everything is in flux.
• Making CS a mainstream subject, including from early years, has consequences right across the educational system.
• Pedagogy is in the early stages.
• Qualifications are in constant change.
• Not enough training and hard to get to it.
• “It’s me, me, or …… me”.
Teacher supply

Since 2012, only 68% of the recruitment target was met for computing teachers, the lowest of all the Ebacc subjects.

The undersupply of qualified computing teachers requires urgent attention.

*The system needs to support teaching in all subjects where there is undersupply.*
Teacher confidence

Continued professional development opportunities need to increase, to ensure teachers are confident in delivering the curriculum.

30% of respondents in secondary schools indicated that there had been a decrease in investment in CPD, and 37% experienced a decrease in time allocated for CPD.

CPD banded hours for surveyed secondary teachers for 2015/2016

Source: Pye Tait
Teacher confidence and supply

Recommendation

Governments and Industry need to play an active role in improving CPD for computing teachers.

Industry and academia should support and encourage braided careers for staff who want to teach as well as work in another field.

Progress made

Government has put £84 million in funding for computing in schools in England. This funding will include:

- A new National Centre for Computing Education.
- A training programme of CPD for secondary school teachers.
- An A-Level support programme.
Computing for all

The challenges

Low and flattening take-up of GCSE Computer Science
No GCSE that covers the entire National Curriculum
Uptake of computing at Key Stage 4

The Key Stage 4 National Curriculum says:

- All Pupils must have the opportunity to study aspects of information technology and computer science at sufficient depth to allow them to progress to higher levels of study or to a professional career.
## Uptake of computing at Key Stage 4

### GCSE Qualifications taken for selected subjects (2012 – 2017)

<table>
<thead>
<tr>
<th>Subject</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ICT</strong></td>
<td>4,647</td>
<td>63,832</td>
<td>87,512</td>
<td>103,342</td>
<td>78,161</td>
<td>69,008</td>
</tr>
<tr>
<td></td>
<td>(37%)</td>
<td>(37%)</td>
<td>(18%)</td>
<td>(-24%)</td>
<td>(-12%)</td>
<td></td>
</tr>
<tr>
<td><strong>Computing</strong></td>
<td></td>
<td>3,867</td>
<td>15,842</td>
<td>33,607</td>
<td>60,146</td>
<td>65,205</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(310%)</td>
<td>(112%)</td>
<td></td>
<td>(79%)</td>
<td>(8%)</td>
</tr>
<tr>
<td><strong>History</strong></td>
<td>209,566</td>
<td>243,852</td>
<td>244,988</td>
<td>237,378</td>
<td>252,075</td>
<td>250,590</td>
</tr>
<tr>
<td></td>
<td>(16%)</td>
<td>(0%)</td>
<td>(-3%)</td>
<td>(6%)</td>
<td>(-1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Geography</strong></td>
<td>175,319</td>
<td>208,447</td>
<td>214,815</td>
<td>218,685</td>
<td>235,818</td>
<td>240,616</td>
</tr>
<tr>
<td></td>
<td>(19%)</td>
<td>(3%)</td>
<td>(2%)</td>
<td>(8%)</td>
<td>(2%)</td>
<td></td>
</tr>
<tr>
<td><strong>Business Studies</strong></td>
<td>65,987</td>
<td>71,888</td>
<td>85,161</td>
<td>91,383</td>
<td>90,169</td>
<td>89,192</td>
</tr>
<tr>
<td></td>
<td>(9%)</td>
<td>(18%)</td>
<td>(7%)</td>
<td>(-1%)</td>
<td>(-1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td>491,777</td>
<td>512,312</td>
<td>596,524</td>
<td>596,767</td>
<td>570,459</td>
<td>573,822</td>
</tr>
<tr>
<td></td>
<td>(4%)</td>
<td>(16%)</td>
<td>(0%)</td>
<td>(-4%)</td>
<td>(1%)</td>
<td></td>
</tr>
</tbody>
</table>

*Increase percentage indicated in brackets

Source: JCQ

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- **70%** of Key Stage 4 pupils attend a school where GCSE Computer Science of offered, but **only 11% of Key Stage 4 pupils take up the subject**.

- Computer Science is only part of the National Curriculum for Computing. The phase-out of ICT raises concerns that **some pupils will not have an opportunity to study computing related qualifications at Key Stage 4**.

- **Technical Awards** partly fill the gap, but have a serious image problem.
Computing for all

Recommendation

Ofqual and Government should work with the learned societies in computing to ensure the range of qualifications includes pathways for all pupils.

Limited progress made

• BCS has set up a Curriculum Committee to provide advice on content, qualifications, pedagogy and assessment methods.

• Ofqual has launched a consultation on how to assess programming skills as part of GCSE computer science.
Improving gender balance

The Challenge

Computer science is the most gendered STEM subject
Improving gender balance

2017 GCSE Gender split

Computing is the most gendered STEM subject

- At A level, uptake by girls drops to 10%.
- The uptake of GCSE Computer Science at single-sex schools was 12.3% compared to just 3.4% at mixed schools.

Source: JCQ
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Progress made</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government and Industry-funded interventions must prioritise and evaluate their impact on improving the gender-balance of computing.</td>
<td>£2.4 million of government funding will go towards a pilot for gender balance in computing in schools.</td>
</tr>
</tbody>
</table>
Education research

The Challenge

Most existing research in computing education has a focus on higher education not on school education
Policy and practice should be informed by evidence

If we are going to spend £1bn on computing teacher salaries, using evidence to increase their effectiveness by 20% is worth £200m

- Most existing research in computing education has a focus on higher education not schools
- The UK capacity for computing educational research is tiny, both in terms of money and people.

Plugged vs unplugged?

Which concepts in which order for which age groups?

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

How do you assess computational thinking?

Discovery, or worked-out examples?

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

Interplay between knowledge and skills
Progress made

The Royal Society and the British Academy published a joint report on *Harnessing Educational Research* assessing the state of educational research and setting out future visions.

Kings College London has established a new research centre in computing education connecting expertise in education, computing, robotics and related disciplines.

Recommendation

Develop a strategic plan including:

- Setting a long-term research agenda.
- Stakeholders committing to this programme.
- Developing UK research capacity.
- Sharing knowledge between researchers, teachers and teacher trainers.
Engaged, curious

Empowered, informed

Creative, playful

Employed
Any questions?
The National Centre for Computing Education
Context

- DfE committed £100m in UK (£84m for England)
- 4 year programme (2018-2022)
- Serious support needed for computing teachers in ALL key stages
Royal Society report – After the Reboot

• Found that computing education across the UK was “patchy and fragile.”
• The future “depends on swift and coordinated action by governments, industry, and non-profit organisations.”
• “Neglecting the opportunities to act would risk damaging both the education of future generations and our economic prosperity as a nation.”
Lots 1 and 2

Lot 1 - The NCCE & Network
- **40** Secondary-school Computing Hubs
- Central repository of resources
- Evidence-based and quality-assured CPD
- Links with relevant industries
- Free, targeted support for priority schools
- Evidence base for effective theory and practice to be further developed

Lot 2 training programme GCSE
- **At least 40 hours** of training, GCSE
- DfE standards
- Includes initial assessment and certification on completion
- Free for teachers and schools
- Includes supply-cover costs
## Lots 3 and 4

<table>
<thead>
<tr>
<th>Lot 3- A Level Support</th>
<th>Lot 4- Gender Pilots</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Develop knowledge-rich resources</td>
<td>- A pilot programme to identify effective approaches to improve gender balance in computing education and increase girls’ participation in GCSE and A-Level CS.</td>
</tr>
<tr>
<td>- Deliver face-to-face roadshows and master-classes for pupils</td>
<td>-</td>
</tr>
<tr>
<td>- Deliver support to A-Level teachers</td>
<td>- This is still under procurement – so more on this at a later date.</td>
</tr>
<tr>
<td>- Free for all A-Level pupils and teachers</td>
<td></td>
</tr>
<tr>
<td>- Targeted at schools and colleges that offer A Levels CS</td>
<td></td>
</tr>
</tbody>
</table>
Our Consortium

• Computing education is the core purpose of each our organisations

• We will provide computing teachers with the support they need

• In the long term it will benefit industry by providing the skilled workforce of the future
Our Consortium

- Lead partner for programme management, reporting and communications
- Recruitment, training, and support for 40 school-based hubs
- Materials for all face-to-face CPD for primary, secondary and FE colleges, including the GCSE programme of support for CS teachers.
  (The hubs deliver the courses)
Our Consortium

- Content development - the Resource Bank
- Online training courses
- Research
- Online user journeys
- A-level programme
Our Consortium

- Academic standards for subject knowledge
- Certification of teachers
- Community of practice
- Industry engagement
Economic benefits

- Ensure the education system prepares young people for the modern world and work
- Harness the power of business to improve the education and skills system
- Create the rights conditions for lifelong learning
- Champion our world-class education institutions, including schools, colleges, and universities

CBI/Pearson Education and skills annual report Nov 2018
How can Industry help?

- Volunteer
- Resources
- Advice and inspiration
- Funding
- Advocacy
Volunteer

• Get involved with current programmes including:
  • STEM Ambassadors
  • Barefoot
  • Code Club
Resources

- Computing educational material
- Subject knowledge expertise
- Students, parents, teachers and schools
- Help shape relevant skills for industry
Advice and Inspiration

- Careers inspiration
- Work placements
- School and college visits
Advocacy

• Tell policy makers why computing education matters to your business
Funding

- Partnership of government, charities and employers
- Provides bursaries for teacher’s CPD
- Funding for existing initiatives and programmes
Questions

supporters@teachcomputing.org
www.teachcomputing.org
@WeAreComputing
DIGITAL SKILLS PARTNERSHIP
Barefoot Computing

Liz Williams, Director Digital Society, BT
November 2018

@L12_W
liz.ea.williams@bt.com
Primary education – Barefoot evolution

Establishing the programme (2014-16)
- Launched 2014 by DfE as a one year intervention
- BT took over funding and management in 2015, in partnership with BCS

Taking to scale (2016-18)
- 1m children reached 2017
- Barefoot taken UK wide
- Professionalised with new look and improved operating model

Creating more impact (2019 onwards)
- Reaching 2m + children
- Launch of new website
- New resources
- New workshop
Primary education - Impact of computational thinking

Teachers who use computational thinking in lessons see positive impacts on pupils’ learning...

- **Problem-solving**: 99% say it helps pupils solve problems.
- **Collaboration**: 82% say it helps pupils work together more collaboratively.
- **Numeracy**: 96% say it improves pupils’ numeracy skills.
- **Literacy**: 69% say it improves pupils’ literacy skills.

www.btplc.com/techlit-primary
Year 2 enjoyed learning about algorithms in computing today!
@MillbankAcad
Welcome to Barefoot, the free computational thinking programme for primary school children from BT and Computing At School.

We want to prepare children to thrive in a digital world.

@BarefootComp
Barefootcas.org.uk
Computing for Schools
And the National Computing Curriculum

Nuno Guarda  nguarda@cisco.com
Head of Corporate Affairs, UK & Ireland
20th November 2018
Computing for Schools

• Networking represents 1/6 of the National Computing curriculum

• Cisco Networking Academy (NetAcad): more than 20 years teaching teachers

• Packet Tracer as a tool to help teachers and students
Computing for Schools

• Collaboration with community leaders
  BCU, The OU, CAS Master Teachers

• Collection of 8 courses created

• Aligned with the National Computing curriculum
  Computing Progression Pathways document, Communications & Networking strand
Computing for Schools

• All learning outcomes addressed
• Each course has 1-2 hours duration
• Embedded assessments (optional)
• Packer Tracer used in practical labs
Computing for Schools

• Available on OpenLearn Create
  (http://cs.co/Computing4SchoolsCN)

• 14,500+ unique visitors
Computing for Schools

• 140+ schools became Cisco Academies

• Adopting other freely available NetAcad courses
  (Cybersecurity, Linux, Programming in Python, IoT, Get Connected, ...)

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Arm School Program

Nicholas Sample and Robert Leeman
Arm’s work in School Education

arm SUSTAINABILITY

arm School Program

team arm
School Education as part of Sustainability

Support for partnerships & technologies that make life safer, healthier & happier for billions of people

We can help people who’ve had no benefit from technology

Example

Partnership with micro:bit on the micro:bit Global Challenge, currently piloting in schools globally. It aims to encourage learners to use technology to innovate solutions to help achieve the UN’s global goals.
School Education outreach

- Many volunteers run Code Clubs
- 40% of children at Code Club are girls
- Connects our people to each other and to the communities in which we work
- Enables us to use our skills, expertise and passion
- Promotes an inclusive culture
- Grows a diverse talent pipeline

61% of volunteering supports educational outreach encouraging and supporting younger generations to get hands-on with technology and pursue STEM pathways
Arm School Program

Working with partners to close the STEM skills gap

**Mission**

To harness Arm and Partners’ state-of-the-art products and tools for teaching and learning in schools in order to:

- close the STEM education gap
- improve diversity in STEM
- and allow learners to realise their potential

**Values**

- Evidence-based approach
- Respect for teachers and the education community
- Constantly monitor and measure our efficacy according to stakeholders’ requirements

**Program structure**

- Community and research
- Content and training
CAS Cambridge Community relaunch
Thank You
Danke
Merci
谢谢
ありがとうございます
Gracias
Kiitos
감사합니다
धन्यवाद
תודה
DIGITAL SKILLS PARTNERSHIP
TEALS Project

https://www.tealsk12.org/
Supporting Computing Education

Volunteers

Encourage your employees to volunteer for computing education initiatives in schools and clubs

Enrichment

Provide talks, mentors, visits, facilities or technology to enrich the student experience of computing in schools

Content

Provide or support the development of computing educational materials for students, teachers and schools

Funding

Provide financial support to computing education programmes

Advocacy

Speak up for the importance and value of a world-class computing education for every child
Supporting Computing Education

Volunteers
- CAS Barefoot
- STEM Ambassadors

Enrichment
- Code Club
- Apps for Good

Content
- Microbit
- iDEA

Funding
- Teacher Bursaries
- Charities and Non-profits

Advocacy
- Policy & public affairs
- Supply chain

To offer your support and get advice on how to help send email to supporters@teachcomputing.org