Computing in UK Schools

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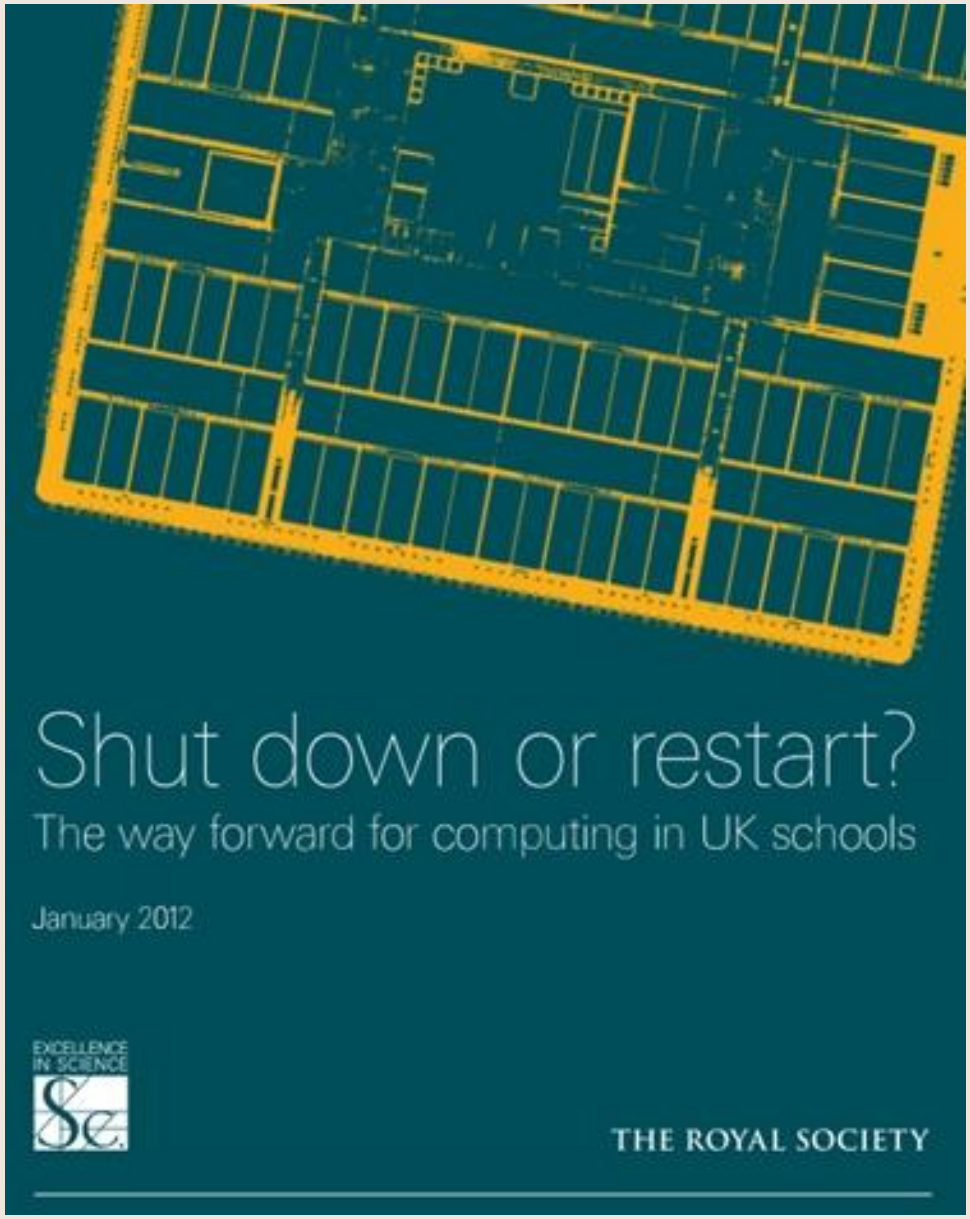
2010-2012



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Project background

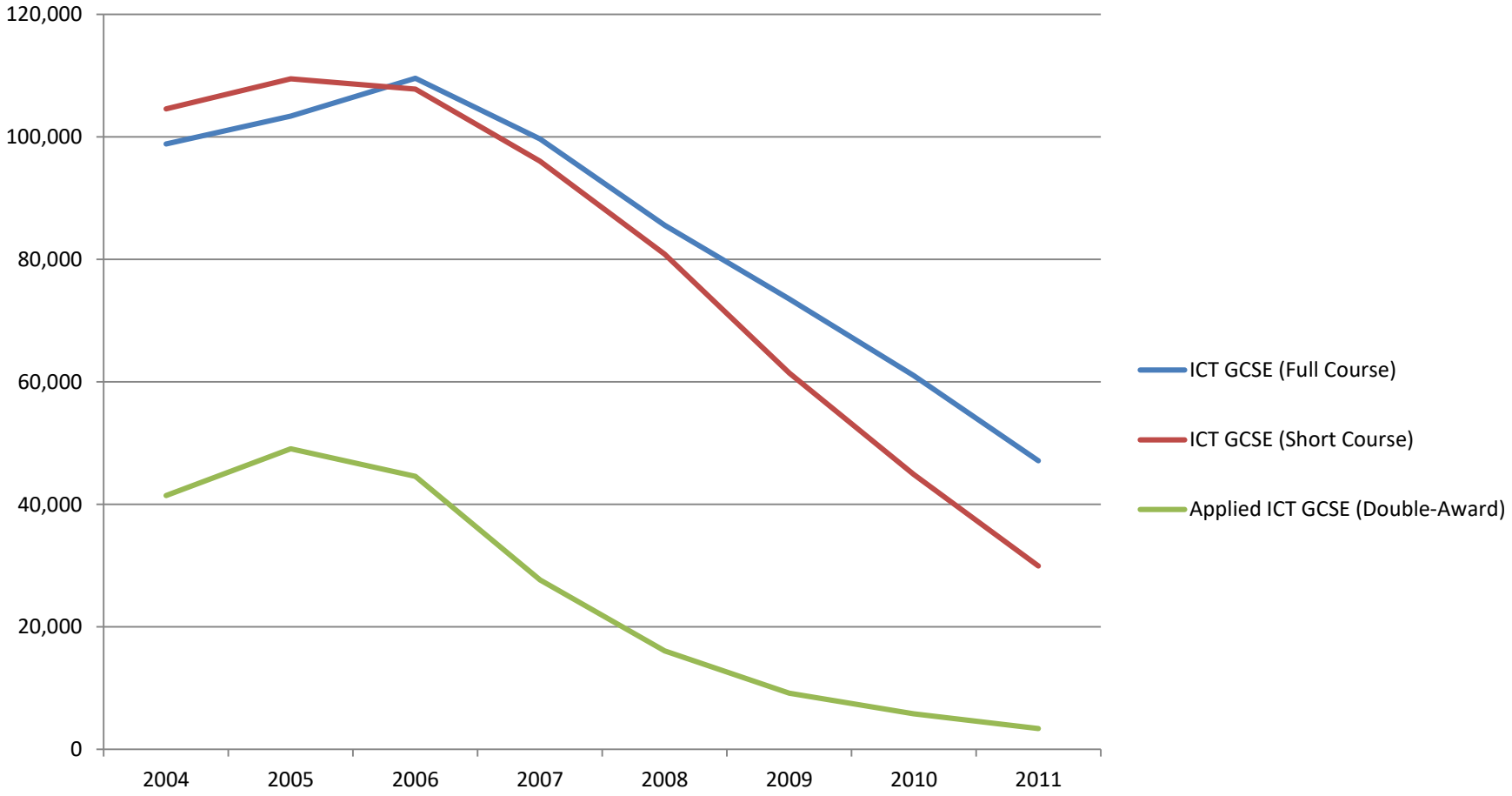
- Delivery of Computing education in many UK schools was highly unsatisfactory. Many worrying reports – including from Ofsted, RAEng, NESTA

- Backdrop of plummeting levels of applications to study computing at university and a dramatic fall in the numbers of students studying ICT and computing at GCSE and A-level (see following slides)

- Concerns that the effect on the economy of this decline would be felt for years to come, in terms of the supply of both a suitably qualified workforce for the UK's needs in an increasingly technologically driven world and the specialist teachers for future generations.

.....Leading to the launch of a Royal Society study of the issue

ICT GCSE



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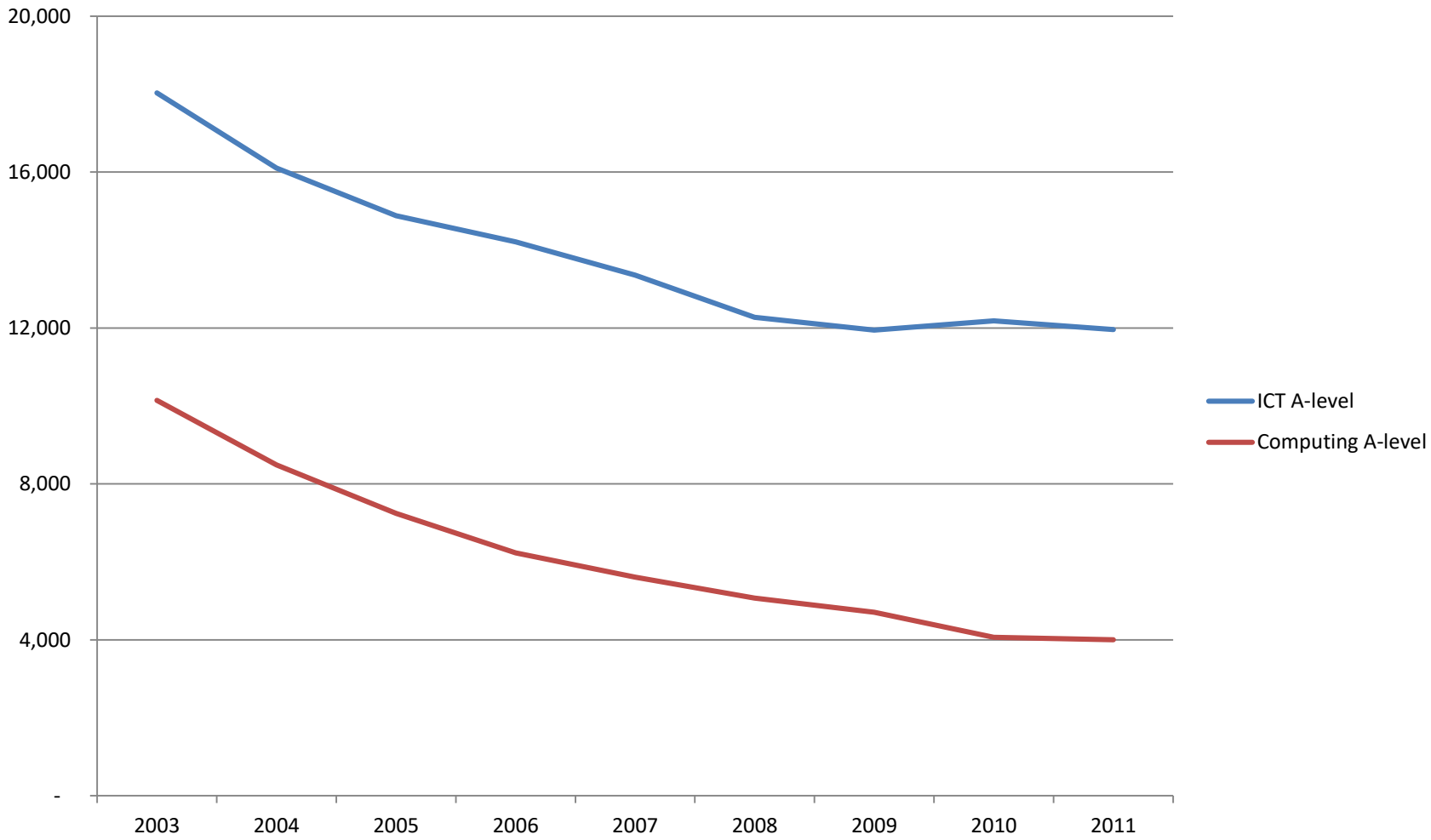
ICT and Computing A-level



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A serious shortage of specialist teachers

- We found many examples of excellent teachers doing a fantastic job – but these are the exception
- When we spoke to young people, many said they knew the subject better than the teacher, leading to descriptions of ICT as “boring”

Recommendations

- The government should set recruitment targets and provide training bursaries
- Teachers need to be supported by professional development that improves subject knowledge

Overhaul of the curriculum

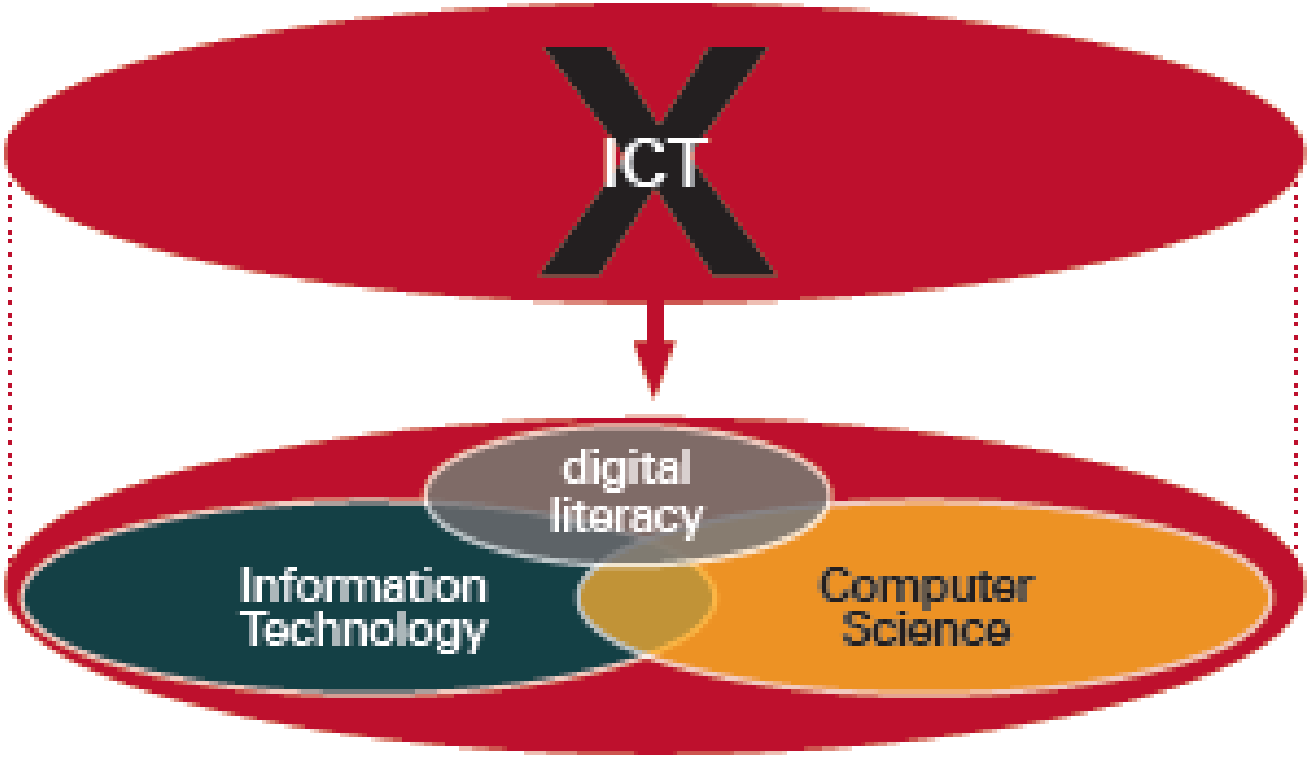
- The ICT curriculum lumped together too many different things, leading to important aspects being missed and confusion

- Gove (government education minister) recognised this and announced a consultation on the scrapping the statutory programme of study

Recommendation

- A new curriculum should have three clearly defined strands – digital literacy, Computer Science and Information Technology – ensuring that the role of each part can be understood and is taught

Terminological reform – 'ICT' is damaged



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The status of Computing in schools needs to be raised

- Need recognition that Computer Science is a rigorous academic subject
- Senior management in schools need to recognise the importance of Computing
- Strong economic and educational arguments – ‘computational thinking’

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Every child should have the opportunity to learn Computing

- Digitally literate' by the end of school
- The opportunity to learn concepts and principles from Computer Science and Information Technology
- DfE should establish schemes of work for 5-14 for each strand
  - Digital literacy
  - Computer Science
  - Information Technology

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New rigorous qualifications are needed

- Universities were luke-warm about A-level Computing and ICT. New courses were needed.
- Computer Science GCSE should be available, alongside new GCSEs in Information Technology, with appropriate assessment methods (not screenshots!)

Network security concerns

- Just as ‘health and safety myths’ can hold back practical science, innovative teaching can be prevented by network security
- A good practice guide was needed, which could be used to negotiate with school network providers

Non-formal learning

- Important element – many of today's coders enthusiasm developed outside of school
- After-school clubs, school speakers, ...
- Augmentation and better coordination of existing schemes

International curricula

- Other countries also struggling with this – no obvious ‘right answer’ and much variety
- But some countries responding positively to the importance of Computer Science – Israel, NZ, Germany, India, USA...
- Israel undertook a major review in 1990s and now has the most rigorous Computer Science high school programme
- Germany in 2008 adopted new high-school standards that clearly distinguish ICT from Computing education
- South Korea’s current high school curriculum already includes some computer science and their proposed curriculum for 2013 includes more on fundamental concepts of computer science

Key recommendations

- More specialist teachers – recruitment and training
- Current curriculum replaced by digital literacy for ages 5-14 alongside the opportunity for all students to experience Computer Science and Information Technology

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What we did

- Panel of experts from across academia, industry, teachers and professional bodies
- 18-month project August 2010 – January 2012
- Call for Evidence – over 120 responses
- Research commissioned – international curricula, supply of specialist teachers
- Stakeholder engagement meetings - March 2011
- Input into the National Curriculum review process

Advisory Group and Sponsors

The Royal Academy of Engineering

IBM

Google UK

Microsoft Research

+ School teachers, academic computer scientists, teacher training…

e-skills uk

bcs The Chartered Institute for IT
Enabling the information society

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A nation of technology creators, not just consumers

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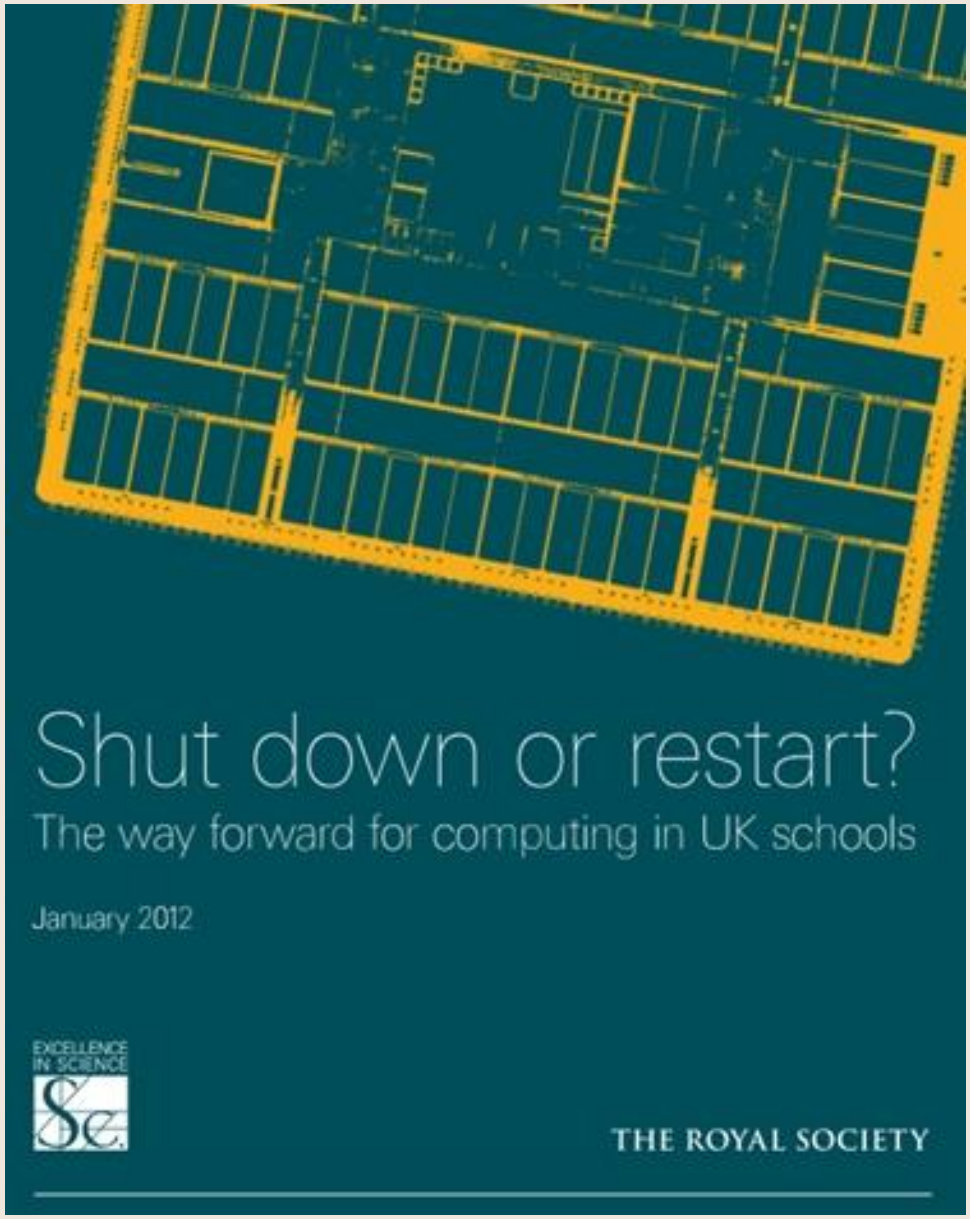
Shut down or restart? (2012)



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2016-2017

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Computing education project: overview

Background

- In 2012, the Royal Society published *Shut Down or Restart?*, a review of computing education in UK schools.
- Despite the near ubiquity of technology, the Society found that there was a dwindling interest in computing in schools and identified a number of actions to address this issue.

Project Aims

- As the subject has been introduced into English schools, the Society has reviewed the impact of computing education in UK schools.
- The report explores how governments, industry, schools and others can build on the progress made since 2012 and provides recommendations to improve the support for the subject.

Evidence

- Survey of 945 teachers across the UK (297 primary and 526 secondary English respondents) and 8 case study schools
- Analysis of uptake patterns at Key Stage 4 and Key Stage 5 using the National Pupil Database (NPD), the School Workforce Census (SWC), and Edubase.
- Three literature reviews from Cardiff Metropolitan University and Kings College exploring the research landscape, pedagogy and assessment.

Key Stage 4 uptake

GCSE Qualifications taken for selected subjects (2012 – 2017)

	2012	2013	2014	2015	2016	2017
ICT	4,6471	63,832 (37%)	87,512 (37%)	103,342 (18%)	78,161 (-24%)	69,008 (-12%)
Computing	-	3,867	15,842 (310%)	33,607 (112%)	60,146 (79%)	65,205 (8%)
History	209,566	243,852 (16%)	244,988 (0%)	237,378 (-3%)	252,075 (6%)	250,590 (-1%)
Geography	175,319	208,447 (19%)	214,815 (3%)	218,685 (2%)	235,818 (8%)	240,616 (2%)
Business Studies	65,987	71,888 (9%)	85,161 (18%)	91,383 (7%)	90,169 (-1%)	89,192 (-1%)
Mathematics	491,777	512,312 (4%)	596,524 (16%)	596,767 (0%)	570,459 (-4%)	573,822 (1%)

*Increase percentage indicated in brackets
Source: JCQ

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The uptake of computing at Key Stage 4 needs to be improved

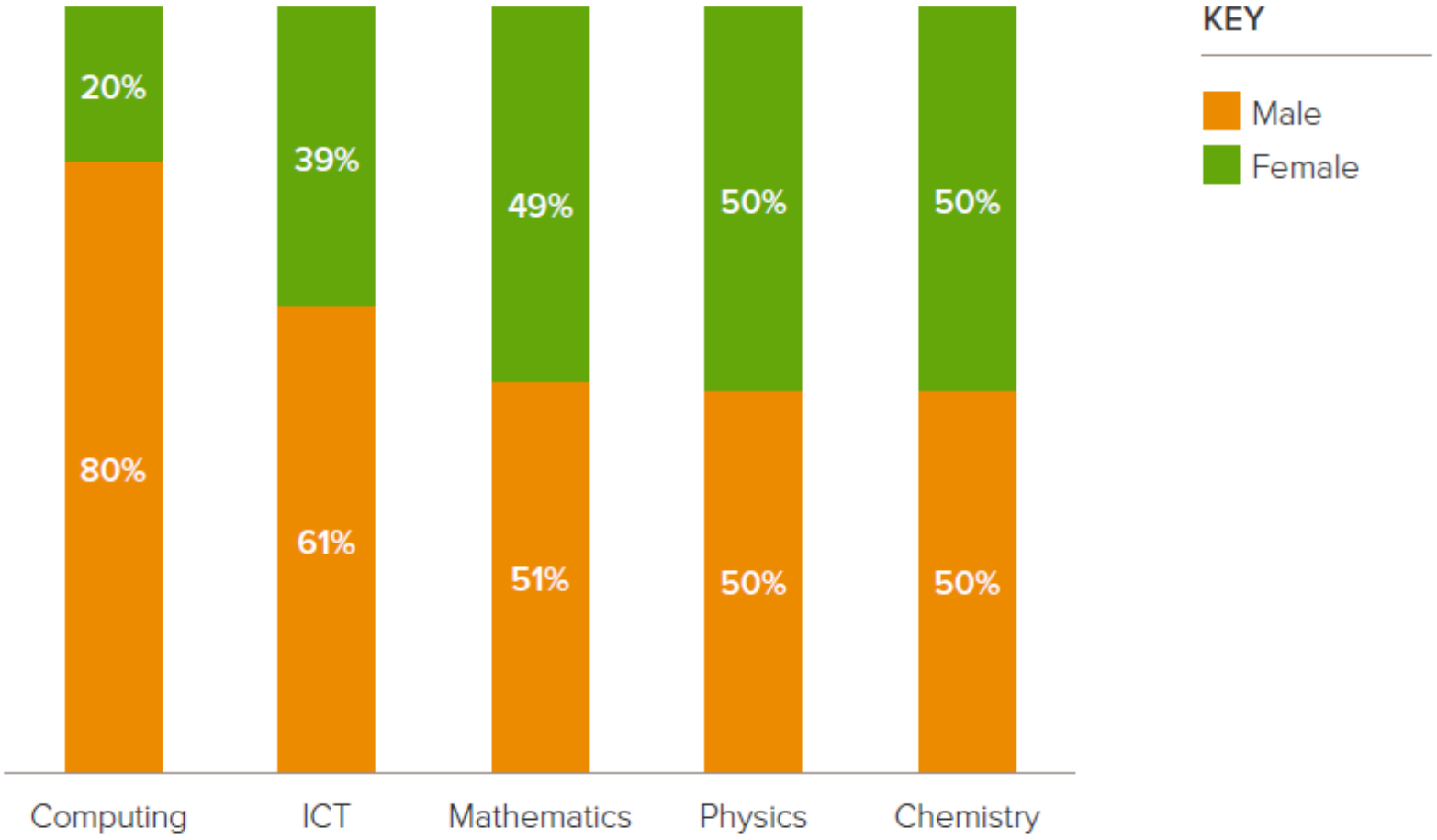
- 70% of Key Stage 4 pupils attend a school where GCSE Computer Science of offered, but **only 11% of Key Stage 4 pupils take up the subject**.
- Computing take-up is correlated with maths attainment: for each additional grade in GCSE Mathematics the probability of the pupil studying GCSE Computer Science increased by 1.4 times
- Despite ICT being phased out, 69,000 students were still on an ICT course in 2017, increasing concerns that some pupils will not have an opportunity to study computing related qualifications at Key Stage 4.

Recommendations

- The computing learned societies should establish a curriculum committee to provide government, Ofqual and the Awarding Bodies with advice on and, where necessary develop pathways in computing for all pupils with an immediate and urgent focus on information technology qualifications
- School governors and Ofsted should monitor whether and how schools are teaching computing to all pupils.

The gender imbalance

2017 GCSE Gender split



Source: JCQ

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The gender imbalance in computing is the lowest of the STEM subjects

- At A level the 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.

- Including computing as a core subject for all pupils from the age of five may help, but Mathematics and physics are still gender skewed despite being part of the primary school curriculum for over 20 years.

Recommendations

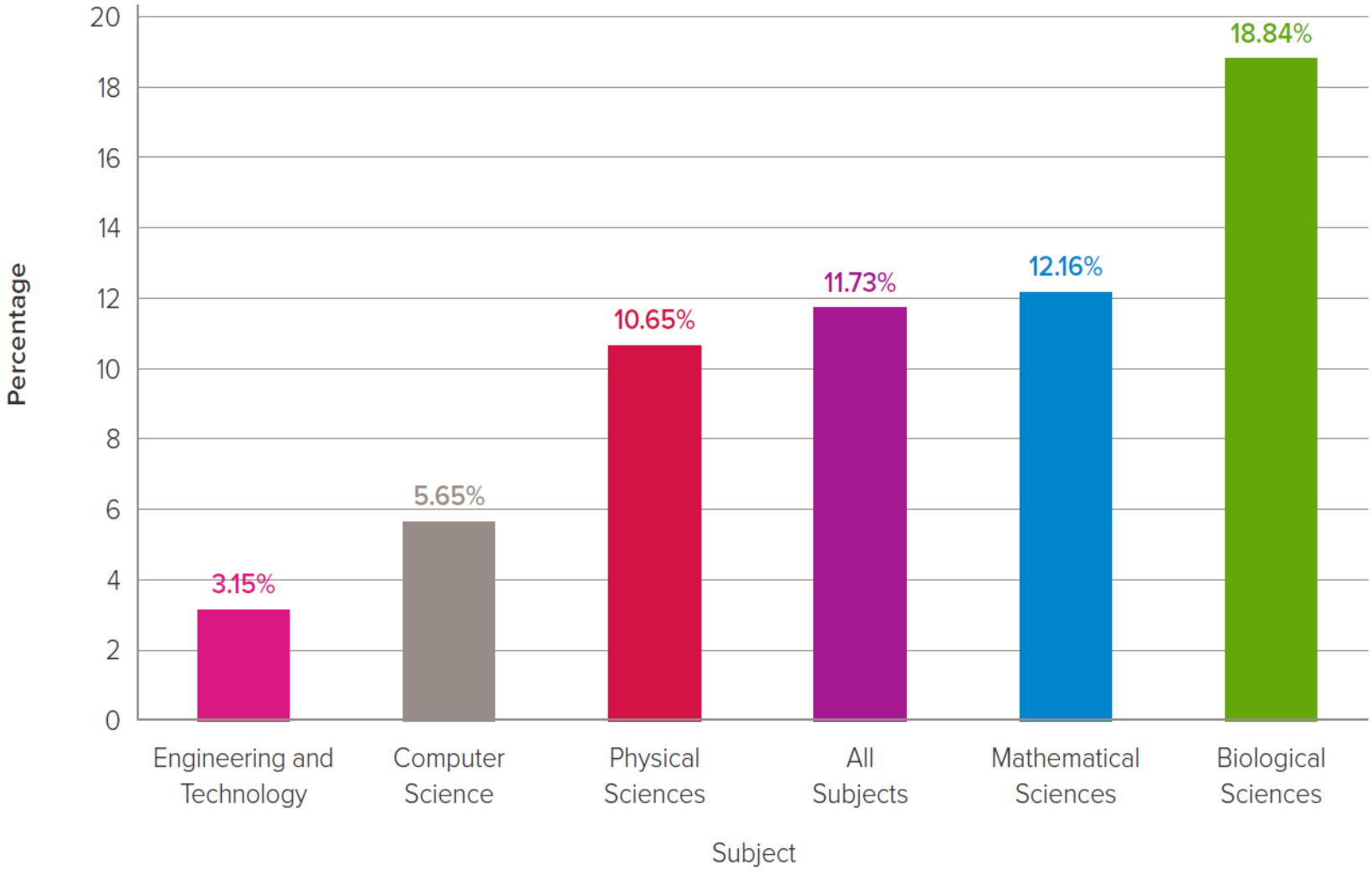
To improve gender balance in computing:

- Government and industry funded interventions should prioritise and evaluate their impact on improving the gender balance of computing.
- Research projects on pedagogy and curriculum development in computing should also investigate how to improve female participation.

The Society is carrying out a rapid evidence synthesis, including seeking to identify potential lessons from successful interventions in other subjects such as physics.

Teacher Supply

Percentage of full-time first-degree leavers working in education post-graduation by subject area (2011/12 to 2015/16)



Source: HESA

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The undersupply of qualified computing teachers requires urgent attention

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

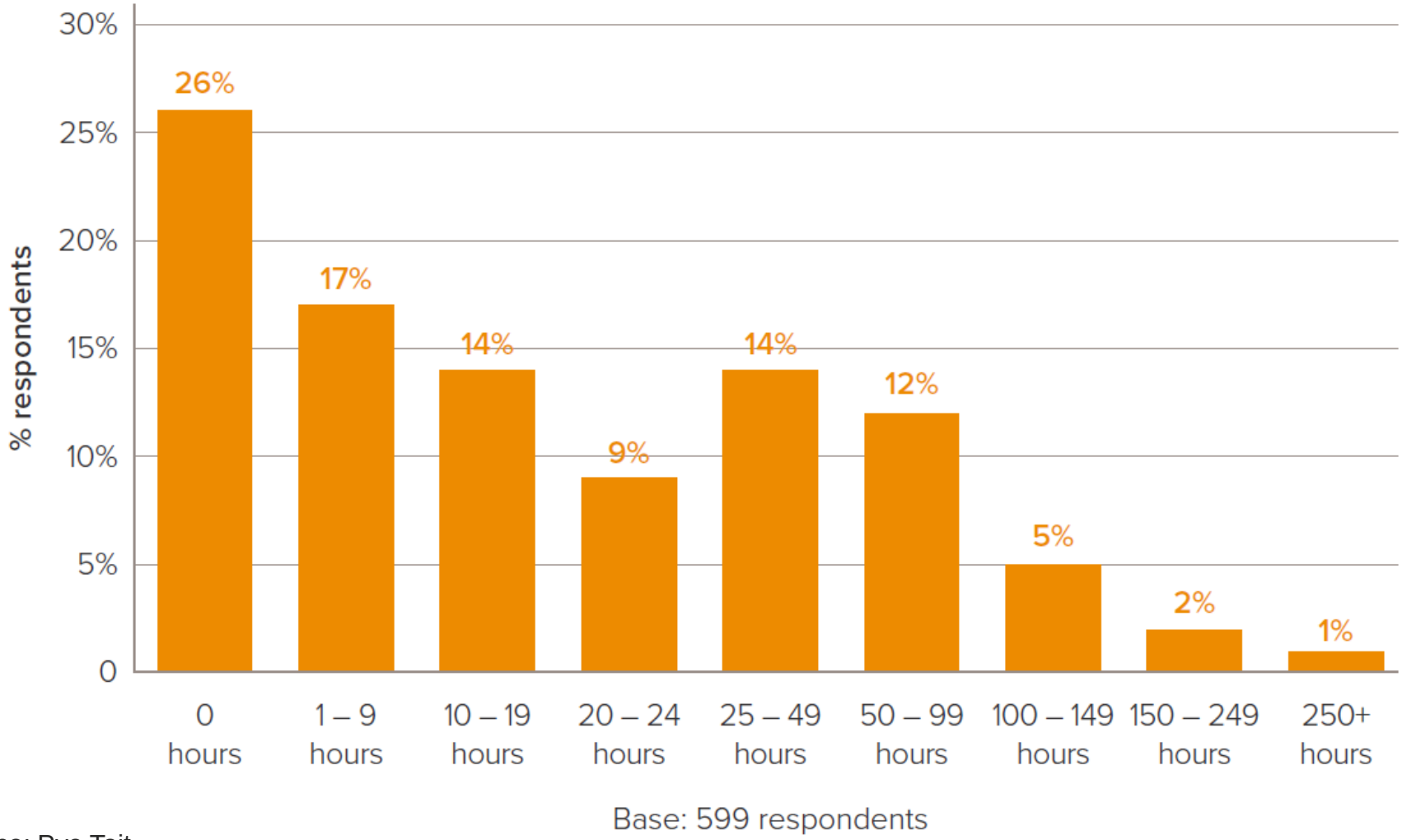
Recommendations

- Introduce quality-assured conversion courses for computing teachers, equivalent to those in physics and maths*.
- Governments should work with higher education providers and the British Computer Society to develop and accredit pre-service subject content courses to enable more people from a wider variety of backgrounds to become computing teachers.
- Expand existing initiatives to support and develop computer degree courses with qualified teaching status.
- Explore opportunities for academics, and those employed in industry, to teach part-time (braided careers).

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

Continued professional development hours

CPD banded hours for surveyed secondary teachers for 2015/2016



Source: Pye Tait

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- 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.

Continued professional development opportunities need to increase

Recommendations

To support in-service teachers, with and without expertise in computing:

- Computing CPD needs **at least a tenfold increase** in investment to be on par with other subjects. This will help expand the reach, and have rigorous evaluation measures in place to strengthen the offer of such networks. £60 million over a 5 year period would provide 8,000 teachers with £7,500 of training.
- A working group has been established with Raspberry Pi, STEM Learning, BT, Twitter, Siemens, JP Morgan, Microsoft and Google to look at computing CPD.
- Financial support should be made available to schools to release staff to attend professional development opportunities.
- Employers need to work with and through the British Computer Society and STEM Learning to provide a coherent offer of teaching support to teachers and schools.
- Research needs to be conducted to improve pedagogy and assessment methods.

After the reboot (2017)

royalsociety.org/computing-education

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Thank you!