

bcs
The Chartered Institute for IT

EDUCATION REVIEW

'Life is not fair, unless we take the trouble to make it fair'

Dr Bill Mitchell
BCS Director of Education
July 2017

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COMPUTING AT SCHOOL
EDUCATE · ENGAGE · ENCOURAGE

Computing At School, part of BCS, The Chartered Institute for IT, the subject association for computing teachers, directly supports ICT and computing teachers.

Membership is free and provides access to: over 4,000 teaching resources, more than 250 local hubs across the country and the opportunity to meet like-minded colleagues.

About us

We are committed to making IT good for society. At the heart of our Royal Charter is a mandate to ensure everyone has access to the widest range of educational opportunities necessary to become creative, empowered, capable and safe citizens in a digital society.

We believe everyone has the fundamental right to a computing education so that they are:

- equipped with the computational-thinking skills to understand and change the world for the better;
- effective at using and applying digital technologies;
- able to fully participate as informed digital citizens in every aspect of society.

We pursue our mission through three key activities:

- we support teachers through continued professional development, helping them to gain training and qualifications;
- we make computing relevant to people through outreach and educational programmes;
- we help people to learn about computing through resources and training.



Introduction

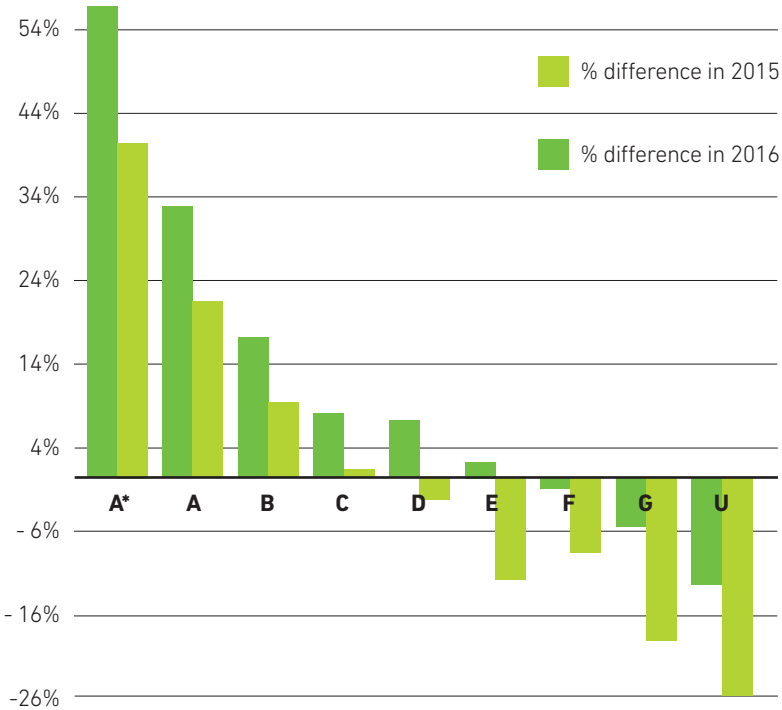
Our world is digital. It is expected that 90% of all future jobs will require digital skills, and it is estimated that the UK will need more than 1.2 million new technically and digitally skilled people by 2022 to satisfy future skills needs.

The UK is facing a skills crisis, there is a lack of young people with work-ready digital and computing skills. To ensure that the digital skills crisis is averted we must ensure that, every child in every school has access to a world-class computing education. And, to get these digital skills, we need to improve the supply of qualified, capable and confident computing teachers. The BCS-run Computing At School (NoE) can and is making a positive difference.

Making an impact

With support from the NoE computing teachers become more effective at developing pupils' advanced digital skills, increase the number of students gaining computing qualifications and improve the grades that students achieve. The work of the Network is having a positive impact on young people's future life chances, supporting them to gain a deeper understanding of computing and thinking skills that give them a much greater chance to thrive in our digital world.





Source: https://community.computingatschool.org.uk/files/8772/original.pdf
% difference in average GCSE Computer Science grades in 2015 and 2016 of CAS NoE reached schools above not-reached schools

Community

Closing the digital skills gap

Advanced digital skills are a major stepping stone to prosperity and improving life chances, yet schools in poorer communities are significantly behind other schools when it comes to developing pupils' advanced digital skills.

Improving social mobility therefore requires that schoolchildren in socially deprived areas gain the digital skills necessary to support their progression into highly skilled, fulfilling, professional jobs.

Making life fairer for poorer communities

Dr Bill Mitchell, BCS Director of Education, explains: '*To understand how well the UK is doing at improving social mobility by developing children's advanced digital skills, we compared schools with a large percentage of pupils who receive free school meals (FSM) to the whole school population. We found that schools with more than twice the national average of FSM pupils are significantly behind other schools when it comes to developing advanced digital skills.*'

The gap will widen

In 2016, schools in poorer communities were 27% behind the national average in terms of all pupils achieving high grades in GCSE computer science. Dr Mitchell goes on to say, '*Without intervention, it is likely the gap will widen and their pupils' life chances will be diminished.*'

We can close the advanced digital skills gap

Research shows that schools in poorer communities which have been supported by Computing At School have reduced the gap by 15.5% when compared to the national average. Dr Mitchell says, *'In a digital world, it's obvious that having advanced digital skills gives people a huge boost to getting on in life. Although we can't expect to make the world perfect overnight, we can make things better year on year. Our findings show that we are not systematically supporting all the schools in poorer communities that need help. It highlights that, when we do support them, life becomes fairer for children in our poorer communities, because they do achieve a higher level of advanced digital skills while at school than they would otherwise.'*

90%

of all future jobs will require digital skills*

*Source: The Tinder Foundation



Bringing programming to life

The primary micro:bit project

Teachers, who may have very little previous experience of programming, are supported by Computing At School (CAS). Its team of expert practitioners is on hand to share subject knowledge alongside practical tips on how to make lessons a success in the classroom.

Practical and fun

Hands-on activities combine knowledge and skills from several subject areas including Literacy, Mathematics, Science, Computing, Art and Design Technology, helping pupils to use and apply computational thinking skills and approaches, including logic, perseverance and collaboration.

Participating teachers reflected that pupils began to relish persevering when they came across challenges within the project. One teacher commented that *'Many of our children do not cope well with failure, but this project improved their resilience and they were encouraged to try and keep trying.'*

Motivating and engaging

Teachers also noted that there was a high level of excitement, motivation and engagement, from girls as well as boys. Pupils were particularly motivated to create code and improve it, once they could see the results physically. *'They thoroughly enjoyed the challenge of coding, especially once they saw the impact it had on the movement of the micro buggies. They wanted to explore, tinker and develop better code.'*

Collaboration

In addition, teachers noticed how the experience supported pupils to improve their collaboration skills. *'Most importantly they needed to work effectively in a small group; collaboration was key and an essential skill that they picked up'.* Employers constantly state that being able to work in small, interdisciplinary teams to solve problems is a key skill that they're looking for in their workforce.





Computing at School (CAS)

With over 27,500 members, more than 245 local hubs, more than 90,000 discussion posts and in excess of 4,200 resources, CAS is a thriving community.

In the last year it has provided 46,710 teacher-hours of CPD to 14,445 teachers in over 3,000 schools.

'I set up a local Hub meeting to share my ideas and new knowledge with a wider audience and make people aware of the fantastic things that CAS offers. I have also become a CAS Master Teacher, a role which I feel incredibly proud to take on. This is the strength of how CAS operates: everyday people enhancing their own practice by learning from the experience and expertise of others, and then giving a little something back of their own. It's a community I feel so proud to be a part of.'

Dan Cumberland, Teacher

The CAS Hub is a local, face-to-face meeting of teachers, universities and local industry to share ideas for developing the teaching of computing. The aim is for everyone to leave the meeting motivated to try something new in their classroom.

#caschat

Every Tuesday night from 8pm, the Twittersphere lights up with CAS members sharing their expertise and practical advice under the guidance of **@clcsimon**. Each week there is a different topic with a series of questions to discuss.

What follows is an hour of rapid advice shared from other CAS members about how they approach that topic in their classrooms, plus some light-hearted chat, but all aimed at educating, engaging and encouraging one another.

- 83 #caschat sessions in last two years;
- average weekly engagement: 100 users, 350 tweets;
- audience from UK, USA, Australia and Europe.



"My confidence has grown enormously. Thanks to everyone at #caschat for their encouragement, reassurance and generosity.

I think leading computing is one of the toughest asks in the primary school; when I meet subject leaders, I explain that #caschat can help."

The Network of Excellence (NoE)

The Network of Teaching Excellence in Computer Science aims to:

- ensure that teachers are equipped to teach the new computing curriculum and qualifications
- raise the quality of teaching in computing and computer science across primary and secondary schools and colleges.

The NoE is a self-improving, school-led system, with computing teachers able to access CPD and support from CAS Master Teachers: excellent computing teachers who understand the realities of the classroom.

This model of school-to-school support has attracted financial support from key global technology companies such as Google, Microsoft, ARM and BT. In turn, it has provided key support for national initiatives such as the BBC's micro:bit programme, with a means to reach teachers at scale.

DfE funding helps grow the NoE through the recruitment and training of CAS Master Teachers, and provides a localised support infrastructure for the Master Teachers through part-funding ten university-based CAS Regional Centres (CRCs). The universities add to this funding through staffing contributions, as part of their outreach work. This model maximises the impact of the DfE contribution.

The NoE support model:

- **Stage 1** – support from the NoE increases the teacher's **subject knowledge** and **confidence**;
- **Stage 2** – the teacher **implements** increased **subject knowledge** and **confidence** in their teaching;
- **Stage 3** – improved teaching leads to higher levels of **achievement** for young people.

99% of teachers feel that the support of the NoE would impact on their practice.

540

CAS Master Teachers recruited, trained and supported

'I was feeling overwhelmed. Although passionate about computing, I was daunted by the scale of the task to improve digital literacy across the school. After a bit of research, I found my local CAS Hub. With friendly and exceptionally helpful members, I could confidently find my feet in my role. After a month of helping, they suggested that I enrol as a CAS Master Teacher, and that's when I saw my journey was just beginning. The huge network of teachers has provided me with support and insight into the world of the computing curriculum, from recommending schemes of work to visiting me and helping me in my new role of computing coordinator. I now have a clear vision of what I would like to do next.'

Newly recruited CAS Master Teacher

The curriculum

The national curriculum for computing was developed to equip young people in England with the foundational skills, knowledge and understanding of computing that they will need for the rest of their lives. Pupils learn how computers and computer systems work; they design and build programs, develop their ideas using technology, and create a range of content.

It was CAS, working as part of BCS, which led the drafting of the new computing curriculum on behalf of the DfE. Over seven million children now have the right to study this curriculum in primary and secondary education throughout England.

Computing, with computer science at its core, is now recognised by schools, parents, universities, employers and government as an important subject discipline, developing the thinking skills, knowledge and understanding essential for every student.

Computational thinking is important. It allows us to solve problems, design systems, and understand the power and limits of human and machine intelligence. It is a skill that empowers, and one which all pupils should be aware of and develop competence in. Pupils who can think computationally are better able to conceptualise, understand and use computer-based technology, and so are better prepared for today's world and the future.

Extending the reach
The NoE has provided over 75,000 teacher hours of CPD and support and delivered over 5,000 training events. Last year alone the NoE provided support to over 3000 schools.



75,000

teacher hours of CPD and support delivered since 2012

Events and outreach

The North West CAS Regional Centre, the University of Manchester, takes stock of the range of events and outreach activities over the last year:

- 300 visits by computer science undergraduates to help teachers in the classroom;
- a programme of school visits to the university, from primary through secondary to A Level;
- joint education ventures with BBC Media City, Robogals, Code First Girls, Code Club, Coder Dojo and TeachFirst;
- annual 'Think Teaching' week with Teach First, to encourage undergraduates to think about teaching as a possible career;
- activities for the public in the Trafford Centre, the largest shopping centre in the North West;
- interactive programming activities for thousands of festival goers at the bluedot music festival at Jodrell Bank;
- the development of Computer Science resources in collaboration with Oxfam, supported by CAS Master Teachers and the regional centre;
- computing activities for girl guides and brownies at the National Football Museum;
- collaboration with Manchester Museum of Science and Industry to provide activities for STEM teachers, schoolchildren and other groups.

5,000

training events delivered since 2012



BCS Certificate in Computer Science Teaching

Dan Cumberland explains how the BCS Certificate of Computer Science Teaching helped him.

'You don't need a Computer Science degree to be a great computer science teacher. The Certificate is designed to create confident teachers of the computing curriculum. It gives professional recognition accredited by BCS, The Chartered Institute for IT."

'Having had no real training in computing, but with my enthusiasm and passion for the subject swelling, here was an opportunity to extend my knowledge and answer the big question that still lingered: – "Am I doing this right?"

The Certificate is in three parts: Part 1 was to show evidence of twenty hours of CPD in computing, Part 2 was to program a game or a simulation to be used within the classroom, and Part 3 was to undertake a research project linked to the pedagogy of computer -science teaching. I chose the guided route, where I would be supported through Parts 2 and 3 through a set of webinars which also contributed to my twenty hours' commitment for Part 1.

From my very first webinar, led by the wonderful Jane Waite and based on the concepts and approaches of computational thinking, everything suddenly made sense. Computational thinking was the answer to my problem – the missing piece of the puzzle. From then on, my teaching of computing was revolutionised.

Design became a huge part of my curriculum, where children would plan, evaluate and then code. I could confidently demonstrate to staff and pupils how we create algorithms and transfer them to code (I loved using the formula 'algorithm + code = program' to make the distinction clear). Abstraction, a concept I had struggled to teach in the past, became a big focus with my more able students and especially at upper Key Stage 2. It was an area I became so engrossed in that I ended up basing my Part 3 research project in it, using some of the wonderful resources created by Barefoot to teach the concept.



I enjoyed the Certificate so much, I gave a small presentation about it at the CAS National Conference. While trying to avoid waxing lyrical for too long, the Certificate gave me the knowledge, the confidence and the skills required to not only teach computing, but to formulate the vision to lead the subject confidently.

The Certificate answered many of my questions about teaching computing competently, but a whole new set started popping up in my head. Do we start teaching Python to our Year 6s in preparation for secondary, or do we ensure their knowledge of computational thinking is robust? Why do girls drop computer science as they head towards GCSE, and what can we be doing at a primary level to prevent this?

Thankfully, I was now part of a network where I could debate these issues with like-minded people.'

Partnerships

Hello World
The computing and digital-making magazine for educators

This magazine, published three times a year, is available without charge as a Creative Commons PDF download. Thanks to the generous support of our sponsors, *Hello World* is available free of charge, in print, for UK-based educators.

https://helloworld.raspberrypi.org

Computer Science Teacher
Insight into the Computing classroom

It is the role of the Computer Science Teacher not only to understand the subject and curriculum inside out, teaching it to their classes, but also to influence their pupils' perceptions of computing and how it will shape their futures. This book explores the role of Computer Science Teacher in a secondary school environment.

www.bcs.org/books/computerscienceteacher

QuickStart Computing

QuickStart Computing is a programme providing all teachers with the resources needed to successfully run computing CPD for colleagues at school or within the local area. It contains essential subject knowledge, plus a framework and guidance for planning, teaching and assessing pupil progress.

www.computingatschool.org.uk/quickstart

Barefoot Computing

Run in partnership with BT, and initially funded by the DfE, the Barefoot Computing project supports primary school teachers to teach the new computing curriculum. By supporting teachers, we are helping schoolchildren receive an excellent computing education, from age five onwards. To date, it has reached 1.2 million pupils and involved 40,000 teachers. 160,000 downloads of Barefoot resources have been made.

www.barefootcas.org.uk



Primary ranking	Secondary ranking
1 Barefoot	1 CAS
2 CAS	

Schools were asked to identify what helped them develop their teaching practise in computing. 900 schools responded and CAS Barefoot was ranked in first place followed by Computing At School by primary schools and Computing At School was ranked in first place by secondary schools.
The Royal Society Report 2017 https://royalsociety.org/topics-policy/projects/computing-education/" After the Reboot: Computing Education in UK Schools.

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The CAS regional centres

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North West (Lancaster)
Lancaster University

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University of Manchester

Yorkshire and Humberside
University of York

West Midlands
Birmingham City University

East Midlands
Nottingham Trent University

East of England
University of Hertfordshire

South West
Plymouth University

South
University of Southampton

Greater London
King's College and Queen Mary University of London

Thanks to Fosse Way Primary School, Lincolnshire and Townley Grammar School, Bexleyheath, Kent who allowed us in to photograph computing teaching in practice, in their schools.

'CAS has played such a huge role in my development as a teacher, a leader and as an individual. The community is its unique selling point; the mantra "there's no them, only us" rings true and everyone is welcomed with open arms. I have now reached the stage where I have felt I am able to give back to the community that has helped and inspired me so much.'

Dan Cumberland
Teacher

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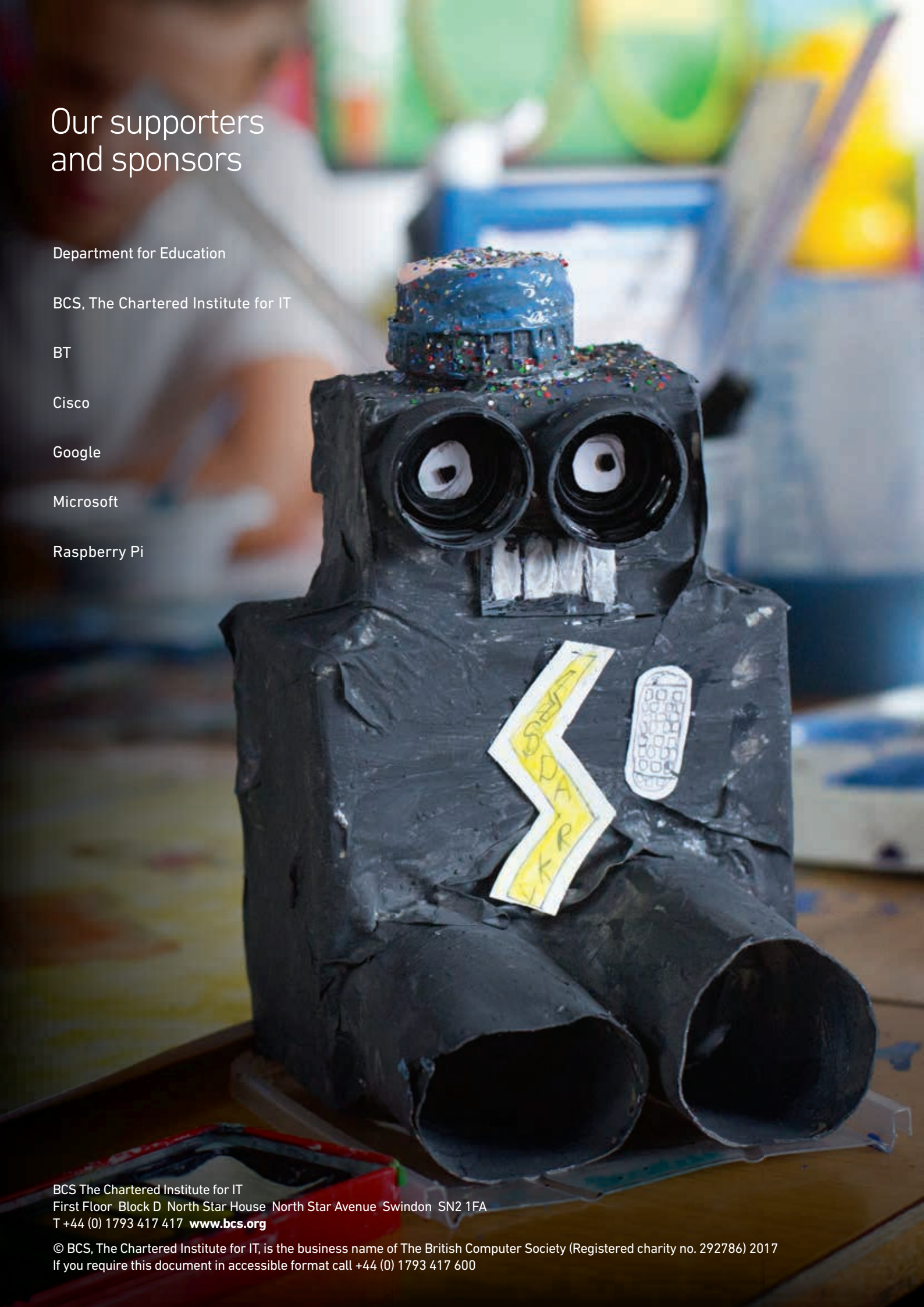

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