Computing at School

Excellent Computing in every School: A Toolkit for School Leaders

Produced with support from Microsoft Youthspark

bcs The Chartered Institute for IT

Microsoft

1. School Leadership and Computing

The importance of computing

Computing matters to the future of the UK, but much more importantly it's about giving every child the essential thinking skills they need to succeed in our digital, connected society. As with any other subject, computing justifies its place on the school curriculum by its contribution to young people's:

- intellectual development, teaching them to think computationally about problems, issues and opportunities and to apply this to wider problems in broader contexts;
- personal development and qualities, increasing their sense of self-worth, resilience and agency through the positive experience of creating working solutions to real challenges;
- wider understanding of the world, where all aspects of human activity are being shaped by the application of computational thinking;
- future employability, with the number of people working as tech specialists forecast to increase by 28 per cent to 1.65 million between 2015 and 2016.

Where we are now?

Schools have made significant strides in developing this new subject. For example, the number of students taking GCSE computer science has more than doubled to just over 34,000. This is encouraging, but there is still some way to go. It is clear from feedback from schools that school leaders have a crucial role in securing computing's position as part of their school's broad and balanced curriculum and ensuring that all young people, including those from disadvantaged backgrounds, receive the benefit of a computing education.

The importance of leadership

As a school leader you have a critical role ensuring the success of computing in your school by

- setting the school's vision, direction and ethos, ensuring that the school maintains a focus on outcomes for all its young people;
- leading change, ensuring the schools structures support rather than constrain the achievement of that vision;
- identifying responsibilities and monitoring performance against those responsibilities;
- recruiting, retaining, motivating and supporting staff, particularly as many teachers of computing will be grappling with new subject content and pedagogical approaches;
- ensuring that curriculum change is properly resourced;
- monitoring progress, maintaining momentum and meeting the needs of school accountability and governance.

This toolkit will help school leaders understand how their leadership can make that happen.

2. The Toolkit

About this toolkit

This toolkit is designed to support school leadership teams in developing computing in their schools in ways that are consistent the school's desire to provide a broad and balanced curriculum to all its students that is in line with the school's mission and ethos. It has been produced by Computing At School (CAS) and BCS with support from a Microsoft YouthSpark grant.

Using the toolkit

The toolkit consists of a set of specific worksheets aimed at helping the school leadership develop and implement the school's computing curriculum. It addresses seven key priorities:

- leadership and management;
- the curriculum vision;
- curriculum planning;
- teaching, learning and assessment;
- staff development;
- infrastructure and resources;
- monitoring and evaluation.

Supporting young people from disadvantaged backgrounds

The particular needs of pupils from disadvantaged backgrounds run throughout this toolkit. Computing and computer science are rigorous, demanding subjects but this should not be a barrier to students from disadvantaged backgrounds achieving at the highest levels. At university level, computer science has been at the forefront of the widening access agenda, with, for example, a far higher proportion of black and minority ethnic students studying it than other more traditional science and engineering subjects.

Using the work sheets

Each worksheet consists of:

- a title;
- who this is for;
- background;
- key questions for your school.

Individual aspects of a development plan for computing are identified together with key questions for the school to consider in its planning. A collaborative approach is recommended with members of the SLT with specific responsibilities, such as curriculum or teacher professional development, working alongside the computing team to consider the questions raised and to identify how they might be addressed through the school's normal planning processes.
A planning sheet is included to help leadership teams record the school's current position ineach of the seven key priorities, the next steps to be taken, who is accountable for taking those next steps and by when.

3. Further Support

Support from Computing At School (CAS)

Unlike curriculum developments of the past where implementation was 'rolled out' from the centre, computing has grown through teacher-to-teacher support in the spirit of a'school-led' system.

CAS has, with support from the DfE and industry, created a network which allows teachers to develop their teaching by sharing their practices at CAS Hubs. Some teachers attend hubs simply to learn, however the greatest benefits come from hosting a hub. These benefits include an opportunity to develop themselves as a skilled computing teacher, drawing together the expertise in their local area, and support from the university-based CAS Regional Centres which can provide a range of advice and practical help.

CAS School Computing Self-Assessment Tool

The prime purpose of this document is to identify the strategic issues for school leadership teams. To help with more detailed planning and implementation, schools registered to the NoE will be able to use an online review tool to assess where they are in the journey to implement computing in their school. The results of the review will help the school's CAS Regional Centre who will be able to work with CAS Champions and others in their region to help that school produce a development plan for computing which will take them through to the next stage.

Further details are available on the CAS website at: **computingatschool.org.uk/schoolleaders**

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Computing at School

Leading and Managing Computing Across the School

Who this is for:
SLT and computing subject leads

"In these challenging times for school leaders, computing will only succeed if school leadership teams are able to manage its implementation strategically."

Duncan Baldwin
Deputy Director of Policy
Association of School and College Leaders

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Leading and Managing Computing Across the School

Purpose

This section of the toolkit is intended to help the SLT clarify leadership and management responsibilities for ensuring all young people across the school receive the benefits of a great computing education.

Background

The school's leadership of computing should inspire confidence and commitment, with effective strategies to delegate responsibilities where appropriate, share good practice and secure high quality professional development.

Clarifying responsibilities

In the past, significant confusion was caused by grouping a set of disparate responsibilities including teaching the ICT curriculum, supporting other teachers to use technology in their teaching, maintaining the school's infrastructure, whole school issues such as e-safety and cyberbullying, and the school's use of technology to support its management, under the single umbrella of ICT. The introduction of computing in the National Curriculum makes clear the distinction between the subject discipline and the wider uses of technology.

This toolkit is principally concerned with teaching computing, however the school's strategy for implementing computing as a subject will clearly need to complement the school's other policies and approaches while ensuring that leadership and management responsibilities are clear. For example, young people will be taught the underpinning knowledge and skills to be safe users of the internet in their computing lessons; young people's behaviour online is a whole-school issue. Both are important and complementary but they are distinct. Similarly, computing teaching will need access to computers, but the requirements for computing teaching are very different from using computers in other lessons.

Key questions for your school

- Does the school development plan identify developing computing as a priority with strategic support from the senior leadership team in terms of resource and timetabling?
- Are the senior leadership team and the school's governors actively involved in supporting and monitoring the implementation of the computing curriculum?
- Are accountabilities and reporting lines clear with distinct responsibilities for computing, technology-enhanced learning, online behaviour and ICT resources?

Recording the discussion: Leadership and management

SLT lead:	Team members:
Where are we now?	
Where do we want to be and by when?	

Owner	Immediate actions	Due
1)		
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Computing at School

Computing and the School's Curriculum Vision

Who this is for:
SLT members and governors responsible for the curriculum

"As a computer scientist, I'm aware of the shortage of computer science and IT skills in the economy, and this is something schools should take very seriously."

Dr Saima Rana
Principal
Westminster Academy

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Computing and the School's Curriculum Vision

Purpose

This section of the toolkit is intended to help the school develop a vision for computing that is clear in its aims, inclusive, linked to the school's wider vision and making a demonstrable impact on improved outcomes for all young people.

Background

What is computing?

A high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world. Computing has deep links with mathematics, science and design and technology, and provides insights into both natural and artificial systems.

The core of computing is **computer science** in which pupils are taught the principles of information and computation, how digital systems work and how to put this knowledge to use through programming.

Building on this knowledge and understanding, pupils are equipped to use **information technology** to create programs, systems and a range of content.

Computing also ensures that pupils become **digitally literate** – able to use information and communication technology to express themselves, collaborate, develop and share their ideas – at a level suitable for the future workplace and as active participants in a digital world.

Developing a vision

The vision represents the future that the school wishes to create. It will underpin the school's strategy for implementing computing in its development plan. While each school's vision for computing may be different, there are key features which all will share, including the differences that teaching computing will make to students' outcomes, attitudes and aspirations. The school's vision will be inclusive, identifying positive outcomes for all learners, including those from disadvantaged groups.

Key questions for your school

- Does your school have a vision for computing in line with its wider vision, direction andethos?
- Is the vision outcome focussed, inclusive and aimed at all young people?
- Does it prepare young people for the future and recognise the need to provide young people with the knowledge and skills to be creators rather than simply consumers of digital products?
- Does it stress the importance of using computing to build on and support other curriculum areas?

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Computing at School

Curriculum Planning

Who this is for:
SLT SLT members with curriculum and assessment responsibilities and computing subject leads

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"Placing and protecting computing at the heart of the curriculum is essential to developing the next generation of creative, innovative and digitally confident young people. It is essential that computing staff are represented on SLT, and therefore able to directly influence strategic decisions about learning if we are to secure such a vision for the present – and future – of learning."

Derek Peaple
Headteacher
Park House School

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CURRICULUM PLANNING

Purpose

This section of the toolkit is intended to help the SLT ensure that the school's curriculum provision for computing meets the needs of all learners, providing appropriate challenges and routes for progression.

Background

Statutory requirements

Every state school must offer a curriculum that is balanced and broadly based and which prepares pupils for their later lives. The computing curriculum should address the three interconnected areas of computer science, information technology and digital literacy, and should focus on developing young people's 'computational thinking'.

Computational thinking

BCS describes computational thinking as the 'the set of mental skills that convert "complex, messy, partially defined, real world problems into a form that a mindless computer can tackle without further assistance from a human". By thinking about problems in this way, young people develop a set of skills that are transferable to other areas of learning and life.

Progression

As with all subjects, the school's computing curriculum should be captured in a scheme of work which clearly shows progression and ensures teaching activities build on existing understanding.

Qualifications

At Key Stage 4, students should have the opportunity to study aspects of computer science, information technology and digital literacy at sufficient depth to allow them to progress to higher levels of study or a professional career. Schools should offer a range of qualifications, including GCSE computer science, that provide those opportunities.

Key questions for your school

- Is there a long-term strategy for imbedding computing in the school curriculum in line with the school's wider vision that will be viewed positively by students, parents, stakeholders and Ofsted?
- Does the school's curriculum meet the needs of all pupils, developing their computational thinking, building their subject knowledge and providing opportunities for them to apply that knowledge in meaningful tasks?
- Does the curriculum address all three aspects of the subject (computer science, information technology and digital literacy) and make explicit connections between them, with other subjects and the applications of computing in the wider world?
- Is sufficient time allocated to ensure all aspects of computing are taught in sufficient depth?
- Is there a mechanism for keeping the curriculum under review and allowing it to develop as teachers' confidence and subject and pedagogical knowledge grow?
- At Key Stage 4, does the school offer a range of qualifications to meet the differing needs of different groups of young people?

Recording the discussion: Leadership and management

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Teaching, Learning and Assessment

Who this is for:
SLT members with responsibility for teaching and learning as well as computing subject leads

"Computing is new and the pedagogy is developing all the time. In their strategic role school leaders should be supporting the development of those new pedagogies and evaluating their impact."

Nevita Pandya
Deputy Head Teacher
Townley Grammar School

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Teaching, Learning and Assessment

Purpose

This section of the toolkit is intended to help the SLT ensure that the teaching of computingis high quality, and that young people's progress is assessed and that assessment informs future teaching.

Background

High-quality teaching

As with all subjects, high-quality teaching of computing requires good subject knowledge and a good understanding of pedagogy. This presents a number of challenges for teachers who are developing the required subject knowledge alongside the pedagogical practice needed to translate that subject knowledge into engaging teaching. The DfE has funded CAS to produce **Excellent computing in every school: Case studies of effective teaching**, which draws on real examples of what great teachers are doing in their classrooms, together with key messages from the wider research into effective teaching and learning. This publication has been distributed to schools alongside this pack.

High-quality teaching, learning and assessment in computing may be characterised by:

- learning objectives that place primary emphasis on the principles and ideas that underpin computing and computational thinking curriculum planning;
- a classroom culture of high expectations, enthusiasm and passion which promotes classroom relationships that encourage students to think for themselves to solve problems;
- teaching tasks that are set in engaging, meaningful and authentic contexts with an appropriate balance of tasks that require the use of a computer and 'unplugged' activities;
- pupils working in a variety of ways in lessons that include an appropriate mix of direct instruction, demonstration, small-group or class discussion, inquiry-based approaches, peer-to-peer coaching and guided exploration;
- the teacher using a range of formative and summative assessment practices to make students' thinking visible, check their understanding, measure progress and inform future learning;
- feedback to students that uses the language of computing and computational thinking and that identifies strategies for improvement rather than merely verifying performance.

Key questions for your school

- Is computing teaching informed by excellent subject and pedagogical knowledge?
- Are new approaches to teaching computing evaluated and shared across the school and more widely?
- Does the assessment of pupils' achievements relate to their understanding of key
- computing concepts and their ability to apply them independently and creatively?
- Does the approach to assessment reflect the school's policies for both formative and summative assessment and reporting?

Recording the discussion: Leadership and management

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Staff Development

Who this is for:
SLT members with responsibility for teacher Continuous Professional Development (CPD) and computing subject leads

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"Where head teachers are providing computing teachers with time to learn new skills and new subject knowledge the impact of the new curriculum is considerably greater."

Simon Humphreys
National Coordinator
Computing At School

bcs The Chartered Institute for IT

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Staff Development

Purpose

This section of the toolkit is intended to help the SLT clarify and identify the CPD needs of staff, access support for meeting those needs, and to build networks internally and externally to ensure the CPD needs continue to be met.

Background

The need for CPD

Given the newness of the subject, many schools experience difficulties recruiting specialist computing teachers – and few teachers in schools currently possess the subject and pedagogical knowledge to teach the breadth of the new curriculum. Many schools will only be able to offer an appropriate computing curriculum to all their young people when sufficient teachers have acquired the necessary subject knowledge and skills. The schools that do best are those where teachers, teaching assistants and technical support staff feel confident and enthusiastic about computing.

The current situation

Various surveys over the past year show teacher confidence in delivering computing in the classroom is steadily improving thanks to a range of grassroots support, including from employers and universities as well as schoolteachers themselves. Locally tailored face-toface CPD seems to benefit teachers the most. Teachers receiving CPD through the UK government-funded Network of Teaching Excellence in Computer Science (known as the NoE) reported their confidence increasing an average of 88 per cent over this last term. Meanwhile, our latest survey, in 2015, showed that the majority of teachers said they received less than five hours of such CPD over the year.

Effective CPD

A review of the international research commissioned by the Teacher Development Trust in 2014 identified that CPD should be well targeted and link explicitly to the curriculum and pupil outcomes. It should address both subject knowledge and subject-specific pedagogy, and be evaluated for its impact. The research identified the importance of collaboration and peer working within and across schools.

Key questions for your school

- Is the SLT aware of the level of subject and pedagogical knowledge for teaching computing in the school?
- Do computing teachers have access to professional development opportunities, including subject and pedagogical knowledge, coaching and mentoring?
- Is the CPD planned in line with teachers' and curriculum development needs and support peer-to-peer working?
- Do computing teachers draw on expertise from outside the school such as CAS and the NoE?

Recording the discussion: Leadership and management

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Computing at School

Infrastructure and Resources

Who this is for:
SLT, network managers, ICT coordinators and computing subject leads

"Effective school leaders are creative people, they thrive on solving problems and will find creative solutions to the challenges."

Sion Humphreys
Professional Adviser
National association of Head Teachers

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Infrastructure and Resources

Purpose

This section of the toolkit is intended to help the SLT ensure that the school's technology infrastructure supports computing teaching while continuing to support the use of technology to enhance learning in other subjects.

Background

The school's infrastructure

Teaching computing places particular demands on the school's ICT systems. Sometimes school policies, agreements with third parties or the specific hardware deployed in schools prevents students from 'getting under the bonnet' to learn how the underlying technology works. Schools have adopted a variety of strategies to provide computing students with the access they need. These include creating a 'sandbox' environment on the school network or creating a bespoke resource using cheap alternatives to conventional hardware.

Unplugged activities

Computing focusses on the underlying principles that underpin the subject, rather than the specific skills associated with specific technologies. Often these underpinning concepts are best taught through 'unplugged' activities away from the computer. These practical activities are often best taught in a room which allows students to work with construction and other materials, rather than a traditional ICT suite. Thought needs to be given when timetabling computing to ensure that a mix of learning spaces is available.

Published resources

In the early days of the computing curriculum teachers often had to rely on the support of colleagues and teacher networks such as CAS for resources. While this is still a great source of material, increasingly as schools need to become more systematic in ensuring they have the necessary teaching resources, there has been a need for guidance on what makes a quality computing teaching resource. The Publishers Association and BESA have produced guidance for publishers and authors of teaching resources for school-age pupils in the UK

(www.publishers.org.uk/about-us/information/guidance-for-the-publishing-of-educationalteaching-resources/).

Key questions for your school

- Does the school infrastructure support the particular needs of the computing curriculum?
- Do the teaching spaces used support an appropriate balance of 'plugged' and 'unplugged' activities?
- Do computing teachers have access to high-quality printed and online teaching resources?

Recording the discussion: Leadership and management

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Monitoring and Evaluation

Who this is for:
SLT and computing subject leads

"The introduction of computing is a significant change with implications for staffing, CPD and resourcing. In their strategic role, school leadership teams need to ensure that the change is properly implemented, monitored and evaluated."

Dr Richard Marshall
Principal
Royal Greenwich UTC

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Monitoring and Evaluation

Purpose

This section of the toolkit is intended to help the SLT put in place the necessary processes for monitoring the development and implementation of the computing curriculum.

Background

Oftsed inspection and the school's business processes

Ultimate responsibility for the computing curriculum in a school sits with the school's leadership team and governing body. Of course, all leadership teams will wish to ensure that the requirements of inspection are met, however as the latest Ofsted inspection handbook recognises, the evidence provided to Ofsted 'should be part of the school's business processes and not generated solely for inspection purposes' (Ofsted). This pack approaches monitoring and evaluation in that spirit.

Monitoring, evaluation and change management

As noted elsewhere in this pack, introducing computing is a change management programme and, as such, has additional components that go beyond many schools' existing arrangements for monitoring and evaluation for school improvement purposes in well-established subjects. By working through the other worksheets in this pack the school will be well on the way to developing an implementation plan. The self-review tool being developed by CAS will offer a structured mechanism for building on these first steps, ensuring that implementation is effectively monitored and evaluated.

Engaging stakeholders

A variety of stakeholders such as school governors, the leadership team, subject teachers, parents and the young people themselves will be able to offer insight into how the school's plan for computing is being implemented.

Key questions for your school

- Have the issues and actions identified using other worksheets been brought together into a coherent plan?
- Have key performance indicators (KPIs) for each of the aspects of the plan been identified?
- Are there clear responsibilities for monitoring the delivery of these KPIs?
- Have the necessary stakeholders been identified and are there mechanisms in place for seeking their feedback?
- Are the needs of all students, including those from disadvantaged backgrounds recognised, monitored and evaluated?

Recording the discussion: Leadership and management

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