Innovate my school

INNOVATE MY SCHOOL GUIDE 2015/16

Contents

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Welcome

to the first edition of the Innovate My School Guide

By Michael Forshaw

Since Innovate My School began in January 2010, our passionate community of thought-leaders have shared some fascinating ideas and innovations for improving teaching and learning in their school - all of which are freely available to read on our website. The Innovate My School Guide builds on these ideas by exploring in more depth, from a wide array of contributors, the 10 most popular topics throughout Innovate My School over the last 12 months.

Within each section, we explore the potential benefits, pitfalls, future trends and learning outcomes for each innovation area, providing you with a warts-and-all view of how they can impact a school and, ultimately, the learning experience of the pupil. We have even included case studies to provide evidence, should you need to persuade any SLT members on the benefits!

> Within each section, we explore the potential benefits, pitfalls, future trends and learning outcomes for each innovation area.

The calibre and number of teachers that want to write for Innovate My School is always humbling. We're lucky to work in a space where passion and enthusiasm is not in short supply, so it wasn't difficult to find 21 creative teachers to share their stories within this Guide.

It can't be underestimated the impact our teacher community can have on teaching and learning throughout the country. As with all of the articles we publish, the aim is to provide a burst of inspiration that sends you off on an exciting journey of innovative ideas to take back to your school. I hope this publication does not disappoint.

Michael Forshaw
Managing Director

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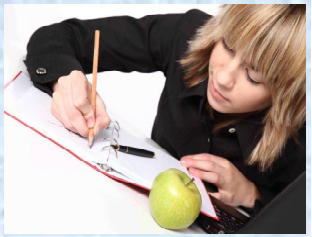

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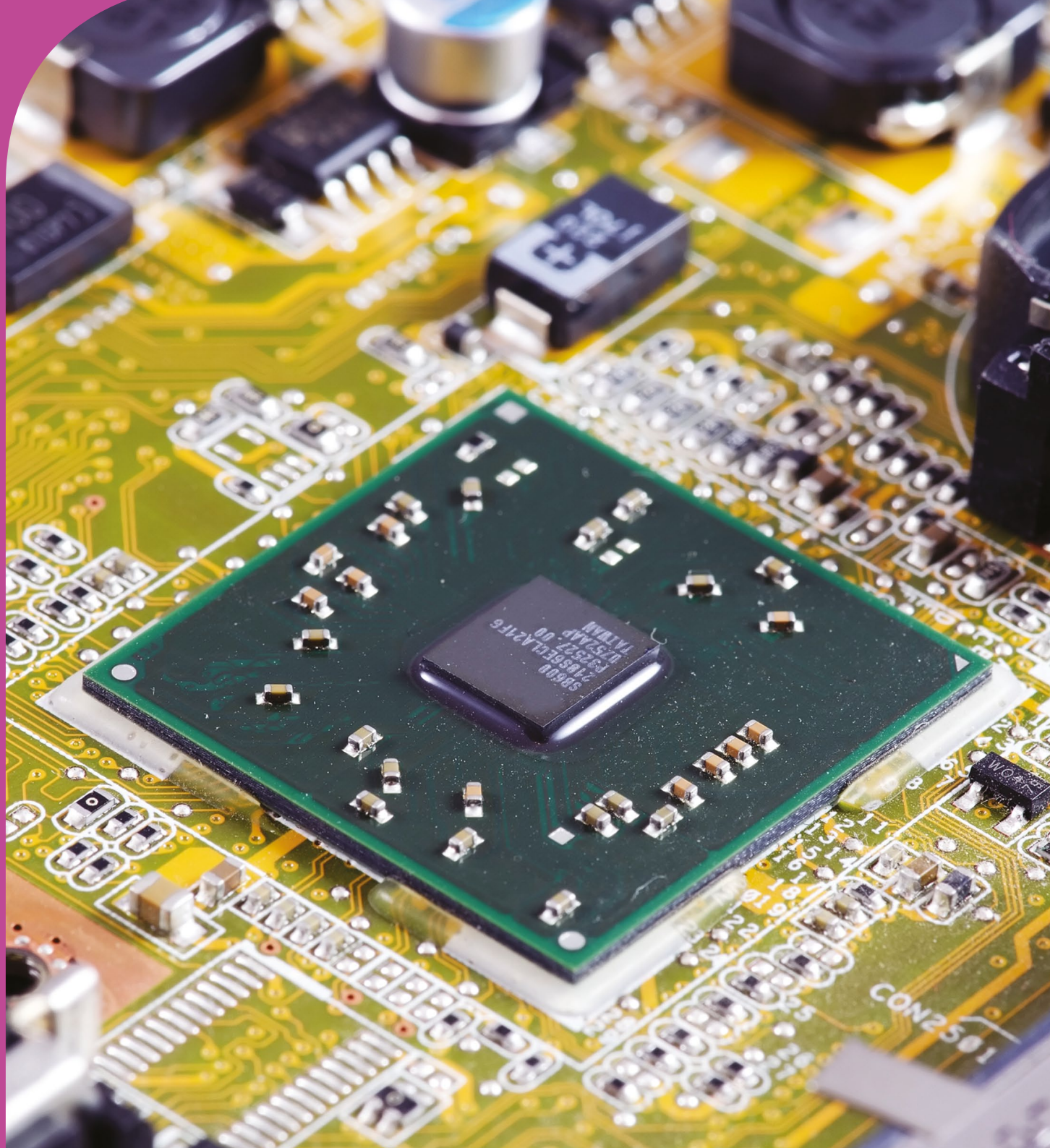
Coding & Robotics



> Coding and robotics provide many opportunities to create innovative products for schools.

Coding & Robotics

Replacing abacuses with algorithms may have lifted eyebrows a decade ago, but the now well-embedded Computing curriculum has ensured that the next generation are experts, not followers, of future technology. Pupils are driving the world's economy forward with the endless digital possibilities that evolve in this digital age.

Understanding how computers work sounds almost archaic in many senses now. The fundamental principles and concepts surrounding computing aren't just being developed to fit in with current technology; they're also being propelled into the world to which we're headed. This is not only fantastical, innovative and exciting, but also necessary and crucial for the UK to remain at the cutting-edge of the digital world.

Robotics is just one way to express creative digital freedom well, given the extensive cross-disciplinary scope for learning and exploring new frontiers. In our complex world, robotic technologies save time, money and even lives. The possibilities as we progress through the 21st century with our coding children is awe-inspiring in itself.

The precise and unambiguous nature of code launches logical reasoning into the forefront of learning journeys, allowing children to not only understand code, but to be the digital leaders of the future destiny of it.

We're delighted to welcome coding and robotics professionals **Simon Howe**, **Mark Martin**, **Nick Dempster** and **Adam Speight** to debate the teaching methods in this innovative area.

Contributors

Simon Howe

Mark Martin

Nick Dempster

Adam Speight

Benefits & Pitfalls

Technology is key in modern learning, but to what extent do coding and robotics play a part in this?

Simon Howe: They help pupils develop improved independence and resilience to learning, as coding especially is focused around problem-solving. The development of critical thinking skills and solving things in a number of different ways is great, and robotics enable pupils to program and create a wide array of solutions to the same problem, in a pupil-led way.

Mark Martin: The journey for many ICT teachers has been tedious, but the reward has empowered them to learn a skill that will transform pupils from being consumers, to creators, within the classroom. Coding and robotics provide many opportunities to create innovative products for their schools and community. It also helps to raise the awareness of the ever-growing technology sector in the UK.

Nick Dempster: Children become so engaged in coding and robotics that they often don't realise they're learning risk-taking, logic, reasoning, sequencing and debugging skills. They relish the chance to help each other to solve errors and debug codes when problems occur. Pupils should be given the opportunity to use something they do not have regular access to at home, and this is especially true when working with robots.

Adam Speight: Learners gain an insight as to how coding and robotics actually work, which enables them to interact in a much more mature and efficient manner. Learners automatically develop a sound awareness of artificial intelligence and gain a more kinesthetic, hands-on experience when learning how to code using robotics.

Nick Dempster: In a technology-rich world, it is not enough to simply use a computer. Allowing children the experience to actually write their own code or apps encourages them to think deeper, and realise just how clever and advanced the technology they use on a daily basis is. It can also encourage more children to develop their knowledge and skills in Computer Science, programming and robotics when they get older.

There are of course potential downsides to any technology-based learning, correct?

Simon Howe: Take your time in selecting the correct coding and robotics solutions for your needs, carefully considering: cost, support, resource, hardware and software compatibility with school IT systems. Make sure your staff fully understand how it works before you deliver to a group. This can be achieved through small group teaching or coding clubs after school.

Mark Martin: The school's IT infrastructure isn't always adequate to meet the demands of the coding and robotics environment. Most IT systems in schools are plagued with filters and blockers, which means the only hope to effectively build something is at home or on a standalone computer.

Nick Dempster: Teachers who are not experienced could be reluctant to use robotics due to fear of something going wrong. My advice is to celebrate failures. Deeper thinking and problem-solving will take place as both the children and the teacher try to defuse what has gone wrong.

Adam Speight: The sole use of visual programming software is, in my opinion, wrong, as pupils need to be introduced to textual programming as soon as possible. Anyone can click a range of buttons, but a real programmer is the person who can write and edit actual pieces of code.

Nick Dempster: The belief that coding and robotics are isolated parts of the curriculum with few cross-curricular links is a pitfall. This can be overcome through the teacher's own creativity.

Taking the Raspberry Pi plunge

By Simon Howe

At a CAS event in June 2014, there was a talk from a lecturer at Manchester University. He talked about a project where all first year pupils were given a Raspberry Pi to keep and use within lectures and Computing labs. So I thought to myself, could I do this for the new Year 10 Computing pupils in September 2014?

The first step was to get my IT suites Pi-friendly. To achieve this, we installed new all-in-one desktops with HDMI out as well as a power cable for the Pi. This enabled pupils to set up their Pi devices very quickly. The second stage was giving the pupils a Pi each to take away and learn with!

> Linux and Python enabled pupils to become more independent and confident in key areas of computing.

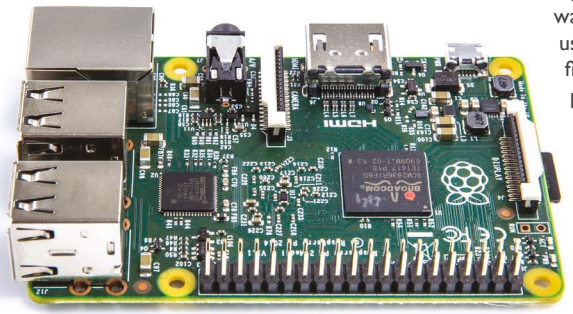
The first few weeks were a steep learning curve for both the pupils and myself. Initially I found that pupils were having a number of problems with the display, SD cards, logging on and sound issues, with each issue taking up lots of time. However, I found after a few chaotic weeks that confidence improved, with us all showing the ability to solve problems at a much faster pace.

> Pupils were having a number of problems with the display, SD cards, logging on and sound.

Throughout the year we did a variety of projects on the Pi, with the main area getting pupils to use the Linux command shell and Python programming. This enabled pupils to become more independent and confident in key areas of computing. For the assessment and storage of work, pupils were using Google Drive to complete and store work to be marked. This also enabled the pupils and I to bypass the IT support team, allowing a fast install of programs without jumping through hoops with an IT network manager.

So a year on, what was the outcome of this project? Overall, a successful one! The promotion of pupils using their Pis at home, as well as pupils producing some fantastic work showing knowledge well beyond the set brief was great to see. One pupil was using the command shell on the Pi, even using a text-based browser for research and finding information on the internet. Another pupil started to do some hacks on his device, due to him forgetting his password and having to gain access. Three pupils on work experience at our partner UKFast used their Linux knowledge to build VMs (virtual machines) and WordPress sites.

There is no doubt that I will be taking this forward to future computing pupils.



The key to my coding classroom

By Mark Martin

At my previous school, I was given the challenge to introduce coding and STEAM (Science, Technology, Engineering, Arts, Mathematics) to my department and wider school community. The job responsibility seemed very daunting, because it required me to have a clear vision that I could carry out and see through. This meant I had to create an ecosystem that could run on its own and without too much micromanagement.

The first step I had taken to introduce coding to my colleagues within the department was to train them over a period of a month. We also included technicians in the process because we felt they would be key to making this roll-out a success. To get Key Stage 3 pupils on board, we introduced morning and after-school code clubs for them to create, innovate and learn the basics of web development.

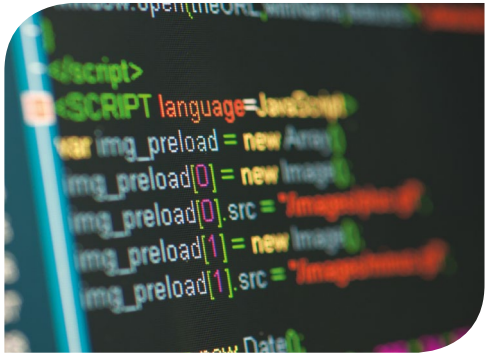
To ensure success, I met with the headteacher to get her backing for the initiative. This was really important, because if the leadership supports the drive, then it makes the task easier in implementing and setting the right culture throughout the school.

> We included technicians because we felt they would be key to making the project roll-out a success.

To sustain the momentum of getting teachers and pupils engaged in coding, I created a coding wall outside my classroom, so that everyone could see its power in today's world. I also invited programmers and coders from the industry in on a fortnightly basis to come and showcase their innovations to staff and pupils. This created a positive buzz around the school and more pupils enquiring about computer science at Key Stage 4.

> I created a coding wall outside my classroom, so that everyone could see its power in today's world.

I took pictures of coding events, posted articles to the school's website and magazine. Pupils in the younger class stated their interest of perusing coding at Key Stage 4, which showed clear evidence that the work being done throughout the school to push the subject was having a positive effect on the young people.



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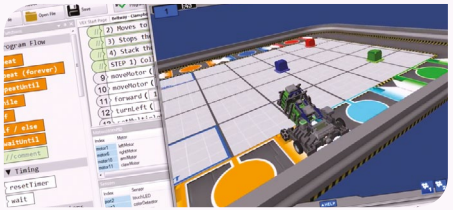
ROBOTC



Programming is a key element of the new computing curriculum and ROBOTC, linked with Robot Virtual Worlds, allows pupils to work one-to-one coding and debugging. They can run code on virtual robots, or the physical VEX robots – allowing pupils to see the actual outcome of their work. Graphical input, progresses to Natural Language and ultimately C++ code. FREE curriculum, sample code and walk-through tutorials allow pupils to grow in confidence as they develop their skills.

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blue{shift} offer creative coding classes and workshops for children in Years 1-8. Our teaching materials cover all aspects of the National Computing curriculum from coding to physical computing.

blue{shift} run weekly after-school coding clubs at schools. We can teach one off workshops or come to schools regularly to teach computing units.

blue{shift} have written a series of books on Computing for Hachette which will be published in Spring 2016.

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Future trends & Learning outcomes

What can we expect to see with coding and robotics in the coming years?

Simon Howe: A shift in focus on security, looking more at how to secure networks, files and encryption. I think we'll also be writing a curriculum around ethical hacking. I can foresee an increase in the number of pupils surpassing their teacher's knowledge of coding, due to the increased independence of pupils learning beyond the classroom. There will also be more physical output for programming languages through various robotic solutions, rather than on screen outputs. Pupils will be increasingly using robotic learning to help solve problems within everyday life.

Mark Martin: Coding will be seen as important as literacy because of the global demand for the skill. The introduction of robotics into the mainstream will lead the education system to think more about artificial intelligence. Designing robots in schools will be seen as a norm, and we will see more inventions being discovered in lessons.

Nick Dempster: Tablet-based resources will continue to develop and become more commonplace. It is far easier from a developer's viewpoint to update and improve an app compared to a desktop-based product. These apps will continue to become more robust, offering more flexibility and potential challenges to the users. The use of models such as Lego WeDo will continue to bridge the gap between on screen programming and physical, robotic programming, and this will be extended through more practical projects using Raspberry Pi and similar kits.

Adam Speight: The computer robotics industry will start growing at a greater rate, and there will be more of a willingness from both academia and industry to work with schools to inspire the next generation. Robotics software itself will encompass more visual programming elements to increase learner engagement.

What learning outcomes have you seen in this area?

Simon Howe: I've seen pupils being more independent learners, having a key skill set to fall back on if they encounter any problems when working. They have better knowledge of code and the ability to create software based on specific problems. More school leavers will be seen going on to computing apprenticeships or university as well, leading to an industry of quality coders. Pupils' enthusiasm around robotics is massive, and when the robots are out, they are instantly engaged, excited and motivated in the lesson. There will continue to be greater creativity within the classroom, with pupils leading their own learning and the teacher there to aid and troubleshoot, rather than lead.

Mark Martin: Pupils develop better computational, analytical and problem-solving skills through programming and coding. They are challenged to think of solutions they can fix with coding or robots in their lives or community. This brings project-based learning alive, and puts emphasis on their problem-solving skills.

Nick Dempster: Coding and robotics encourage risk, trial and improvement during the coding process. It improves logical thinking, sequential learning and abilities to debug - these skills can be applied to other areas of the curriculum as well. Children also gain a sense of achievement from physically programming a robot. Watching their work be brought to life allows pupils who are not necessarily academically gifted to flourish, improving communication skills and encouraging them to demonstrate their understanding to other pupils.

Adam Speight: Pupils can reflect upon a piece of given source code and interpret what it actually does. They learn to handle and further develop a piece of given source and display greater signs of computational thinking. It's a kinesthetic learning experience which introduces them to the world of artificial intelligence.

BYOD

Bring Your Own Device

> By pupils using their own devices in lessons, I find engagement in the learning improves.

BYOD

Whether you think BYOD is the key to schools keeping up with the continual digital advancement in the classroom, or just a teacher's constant headache with a distracted class and overworked infrastructure, one thing's for sure: this is still one of the most talked about developments in recent years.

Love it or hate it, technology follows children around. Phones and tablets are attached to the hip, and it's for schools to decide on whether they embrace the changing trends, or stifle it at the risk of endangering the creative and technological advancement of pupils.

Driving forward, the question will not be if, but on what scale, do we roll it out? There's no denying that tablet learning enhances achievement through creative freedom. However, as tablets embed themselves in our everyday lives, allowing us access to the entire world at our fingertips, the way in which this is supported, planned and controlled in schools with network infrastructure is crucial.

It's safe to say the BYOD debate will continue to challenge school leaders over the coming months as policies regarding equality issues of pupils dominate the agenda. Finding economical yet fair and inclusive solutions to the issue of differing BYOD models, dependant on individual financial situations, will be one of the main challenges for school leaders to embrace and address.

Here to discuss are teaching experts in the field: **Sarah Bedwell**, **Rachel Jones**, **Dominic Norrish** and **Adam Speight**.

Contributors

Sarah Bedwell

Rachel Jones

Dominic Norrish

Adam Speight

Benefits & Pitfalls

What kind of benefits can teachers expect from a BYOD programme?

Sarah Bedwell: BYOD can bring about significant cost savings on infrastructure, as pupils are already familiar with their own devices, and can often use them in creative ways that teachers haven't yet thought of. Pupils can learn at their own pace and recap lesson content, and as most devices used by pupils have instant access, there is less learning time wasted waiting for computers to boot up and pupils to log in.

Rachel Jones: BYOD not only provides an excellent platform for collaborative working, but also an innovative way of allowing successful and meaningful differentiation between learners. By pupils using their own devices in lessons, I find engagement in the learning improves and it empowers learners, as they're using something that they're used to at home, to learn something that they may not be as familiar with in class. This inevitably sparks curiosity and awe about learning in some sessions; something that I feel is often lost during Secondary school.

Dominic Norrish: Gibson's oft-quoted 'The future is already here — it's just not very evenly distributed' is the main reason for going BYOD. Done well, it puts an extremely empowering learning toolkit in every pupil's hands, totally disrupting the current model of school ICT. In the medium-term, BYOD schools will shift their operating model for IT to "we'll provide the infrastructure and services, the user will provide the device". Today's learners are permanently connected to their own social, academic and interest networks through a device. BYOD done well brings the school into this circle.

Adam Speight: It empowers pupils to learn more efficiently, as they can use a piece of technology they're comfortable with in order to solve a particular problem. It enables digital learner systems to be set up, which can increase pupil confidence and get certain pupils involved who may not necessarily like getting involved in other school activities.

What limitations or pitfalls could present themselves?

Sarah Bedwell: Equity of access must be considered carefully. This goes for both access to devices, but also to Wi-Fi / data. There are other infrastructure considerations to be made, including network access, filtering and safeguarding, as well as physical protection for devices against breakage and theft. Teachers need to strictly monitor use of devices until trust is built up between staff and pupils - this can take significant time. Considerations for limiting use outside the classroom may need to be made as well.

Rachel Jones: The BYOD model does rely on positive drivers in school to embed good practice. It's not something that I believe can be introduced into lessons in a rush; it certainly takes training, time and effort and staff need to be fully supported by SLT and governors.

An important point with BYOD is never to assume that all children will be confident and good at using technology for learning. It's easy to forget in the technological environment we live in, but for some, the thought of learning on their own, or with a borrowed device, will be daunting.

Dominic Norrish: There is the issue of legitimising illegitimate use: the problem of pupils' phones as weapons of mass disruption becomes harder to manage when the fall back excuse of "I'm doing my work on it" becomes available. Also, far from bridging the gap between the poorest and wealthiest pupils, BYOD exacerbates it, with the less well-off often opting out entirely as a result of the fear of social shame.

Adam Speight: Clear rules and guidelines need to be drawn up by all stakeholders within a school environment before introducing BYOD, and pupils should be made to only use school Wi-Fi systems as opposed to their own so that safeguarding can take place by monitoring what their device is being used for.

Sarah Bedwell: And always remember - teachers still need a back-up plan!

Battling through BYOD restrictions

By Sarah Bedwell

Convincing my headteacher to give BYOD a go wasn't easy. In fact, it took several years of casually dropping it into conversations, outright persuading and highlighting all of the potential benefits (I think he'd call it nagging!) before he capitulated. My school is in an area of economic and social deprivation and we, like many other schools, have faced increasing budget constraints in recent years. Our IT infrastructure was ageing and in dire need of replacing. I think it was the financial argument that convinced my headteacher in the end. We were able to delay wholesale computer replacements by two years by introducing BYOD.

It took a lot of planning and negotiating with SLT before we kicked it off. We had to keep equity of access in the forefront of our planning, as well as network security, safeguarding and device security. All of this is built into our very comprehensive IT policy. Pupils are welcome to use their devices if a teacher is displaying a green sign on their classroom door, provided it's being used as per the teacher's instructions. A red sign indicates that devices are banned and will be confiscated if seen. Devices are also banned in all communal areas at break and lunchtimes.

> Pupils are welcome to use their devices if a teacher is displaying a green sign on their classroom door.

The end result is more creative pupils. They produce their own images for use with Photoshop in Computer Science. They are coding their own games, manipulating images in Art, researching products and pricing components in D&T, blogging in English, using a huge range of apps in Performing Arts (GarageBand is a favourite with pupils), and watching experiments that for various reasons can't be undertaken at school in Science. They're recording live data in PE, accessing the Khan Academy in Maths, and so much more. This year we're dipping our toes into flipped learning, based on the premise of pupils being able to use their own devices.

It takes careful planning and even more careful monitoring of pupils using their own devices at school. It also takes a huge amount of trust between staff and pupils to know that pupils are only using them for work and not social media in lessons. There must be clear consequences for breaching the rules, and a consistent application of the IT policy. All in all, it's had a demonstrable benefit to our pupils and their learning.

BYOD: How it's transforming 1:1 learning in class

By Rachel Jones

My school rolled out 1:1 BYOD in Years 7 and 9, and intends to repeat this over three years until the entire school is 1:1. The reason for doing this was to make manageable waves of year groups with technology, so that teachers could become used to and eventually practiced at teaching with the pupils having the devices.

> Giving everyone time and space to grow their confidence was really important.

The confidence of teaching staff has been paramount, and there has been extensive (and continuing) staff training during INSET and twilight CPD sessions. Training all those concerned has been time-consuming but vital, and has included parent and pupil sessions so that we could engage the major stakeholders in the school community.

> Training all those concerned in BYOD has been time-consuming but vital.

At the same time we also launched Google Apps for Education, which was particularly well received by pupils and is now being well utilised by staff.

Another key thing that made the roll out successful was the formation of a keen group of pupil digital leaders, who are able to provide peer support as well as staff training. Giving everyone time and space to grow their confidence, as well as sharing good practice, was really important. Having a member of staff who was responsible for driving this change was also paramount, as was admitting mistakes we made and being willing to be responsive and flexible to the reality of having technology in school, rather than an idealised view of what it would be like.

Get started!

Read about a selection of products and services that can assist you with BYOD in your school.

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Future trends & Learning outcomes

With all this in mind, what BYOD trends can we expect to see in the future?

Sarah Bedwell: Schools are going to have to be continually adapting their technology offerings, while ensuring that monitoring and filtering services are adaptable to the constantly changing technology available to pupils The need to teach digital citizenship across the curriculum will go hand-in-hand with the increase in BYOD usage. In short, schools need to embrace the technology that pupils are already bringing in, and all of the benefits that go alongside it, while still ensuring that equity of access and safeguarding remain priorities.

Rachel Jones: Could we be seeing wearable technology such as Google Cardboard? Or BYOD on multiple platforms? Wider school subscriptions to services such as Google Apps for Education are certainly on the cards, as well as the integration of augmented reality into more text books / school resources.

Dominic Norrish: I can see BYOB - Bring Your Own Browser - as a realistic alternative to a single platform 1:1 scheme getting closer all the time. BYOB schools will define an ecosystem that allows the key tasks of file management, collaboration and workflow to take place using multi-platform apps or a browser. Good examples of such ecosystems are Microsoft's Office 365 and Google's Apps for Education. It's only a question of time before equivalents to the 'killer apps' that people buy for iPads are also available via a browser.

Adam Speight: More published research will come about which shows BYOD policies can work if implemented correctly. I believe there will be less excuses about introducing a BYOD policy as mobile devices become even cheaper and affordable for everyone.

What learning outcomes have you experienced with BYOD?

Sarah Bedwell: Instant access ensures less learning time wasted waiting for traditional technology, for one. Pupils are already familiar with their own technology and often use them in creative ways not envisaged by staff. There is huge potential for personalised learning and differentiation through using BYOD as part of a flipped learning programme.

Rachel Jones: BYOD can provide learners with the maximum potential learning opportunities. It ensures that pupils are given the opportunity to be makers on content, and to be creative with their learning. Teachers need to make sure that the focus of a BYOD policy is pedagogy, not technology.

Dominic Norrish: I've experienced higher-quality outcomes from pupils, greater time spent on each task, and increased collaboration between pupils. BYOD offers improved communication between pupils and teachers, enriched perceptions of relevancy of learning tasks and, most importantly, enhancements to an acceleration of some of the key processes which underlie learning.

Adam Speight: BYOD allows pupils to reflect upon how a piece of technology can add value to a learning environment. It builds up a school infrastructure which will allow a BYOD policy to be successful from the offset, and empowers pupils to make decisions as to how they would like to go about producing a particular piece of work.