The Importance of Technology
The technological revolution in schools
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We are undergoing a technology revolution: it is global, far reaching, fast moving and is undeniably transforming how we live, play, learn, work and do business.

The impact on schools, teachers and students cannot be underestimated. It is clear that for many schools, the era of top-down support relating to ICT is a thing of the past, having been replaced by teacher-led, network-driven professional development and supported by student-led innovation. However for many other schools, this is still an area requiring significant development and support.

UK schools have built an excellent reputation for engaging with technology and have led the way in many areas of pedagogic innovation and strategic development, but there is still much work to be done if we are to ensure we can continue to compete in an ever growing global education market.

This paper examines the current position of UK education in this fast moving landscape and examines the lessons from other countries. It makes recommendations that will help support current education policy and guide schools in providing opportunities for all our students.

We do not see this as a closed paper, but rather the beginning of a fresh era of debate and development and we would encourage schools and partners to continue to join with us in sharing the very best innovative practice and ideas.

The content of this paper was developed and constructed by the Schools Network in partnership with its affiliated schools, industry partners, Naace, Connecting Learning and other key education providers. I would like to thank schools and our partners for their input. A full list of acknowledgements can be found at the rear of this document.

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Whilst there is often debate on the exact definition of the terms used, for the purposes of this report, the following applies:

**IT: Information Technologies** - refers to the generic management of technologies in the wider economic sense. The IT industry supports infrastructure, hardware, consumer computing products, software etc.

**ICT: Information and Communication Technology** - is concerned with the development and use of digital systems and content in all contexts. It encompasses, but is not limited to, digital literacy, creative applications, computing and business uses.

Computing (or computer science) - refers to the scientific development of hardware and operational software in pure computing terms.

Learning Technologies - refers to the application of IT and ICT to enable and enhance teaching and learning.

**Self Review Framework (SRF)** - offers a route for assessing and improving a school’s use of ICT. The framework is used via an online tool and linked to national standards for ICT.
Executive Summary

There is a revolution underway in technology which is radically transforming the world of work and the lives of young people. Schools need to embrace and adapt to this change – grasping the opportunities it brings – or risk creating an obsolete generation, unprepared for the rapidly globalising workplace.

Many schools and their partners have already recognised this and are leading the way in the development and adoption of opportunities that technology brings. If Britain is not going to be left behind, these lessons need to be learned fast and by all schools.

We need to draw on the enthusiasm for and knowledge of technology which young people demonstrate, and use this to keep our schools up to date.

We need both to instil a knowledge and understanding of technology in young people and then to go further – getting them engaged and participating in producing and disseminating knowledge. These traits will be the hallmark of our future knowledge economy.

In this context and with a clear understanding of the need to gain good value in education, we propose a number of reforms which will help to harness this revolution and secure improved value for money throughout the school system…

‘One of the greatest changes can be seen in the lives of children and young people, who are at ease with the world of technology and who communicate, socialise and participate online effortlessly... Children are increasingly embracing technology at a younger age...yet the classrooms of today don’t reflect these changes. Indeed, many of our classrooms would be very recognisable to someone from a century ago. While there has been significant investment in technology in education, it has certainly not transformed the way that education is delivered.’

Secretary of State for Education, The Rt Hon Michael Gove MP, to The Schools Network Conference, 1 December 2011
Recommendations summary

- Government must set out a clear recognition of the key role that technology will play in schools in future by publishing a technology strategy as soon as possible.

- Schools must have the freedom to decide how they use technology in the classroom but they should be held accountable for their success in preparing their pupils for the global workplace – using measures agreed with industry.

- Schools should use the technical know-how of their pupils to help drive innovative use of technology and to up-skill their staff.

- The best and most creative uses of technology including smartphones, media devices, tablet computers and cloud technologies in schools, should be more widely shared within and between schools.

- The existing ICT Curriculum should be overhauled, so that it provides challenge and a scope for creativity whilst also providing a grounding in digital literacy and computational thinking for all. Delivery could be as a discrete subject, embedded, taught and assessed within other core curriculum subjects or as some combination. A modular approach would allow progression to stand-alone IT, computing, or creative media qualifications developed with industry. The Schools Network will work with partners and industry to help move this forward.

- A new technology curriculum at GCSE standard and above should be developed, including computer science and programming, to help prepare students for advanced qualifications and work in the creative industries. This subject should be given as much recognition as core subjects within the English Baccalaureate. The Schools Network will work with partners and industry to help move this forward. National standards for e-Assessment should be established that build on the work carried out by e-Assessment Advisory Group and the e-Assessment Association.

- Schools should take advantage of the evolving Self Review Framework tool, to help them evaluate their use of technology continuously and to identify key areas for improvement.

- Training should be developed for teachers and school leaders to keep them up to date with developments in technology and how to get value for money from it.

- Teacher-led professional development networks and activities such as TeachMeets should be supported by making them count towards professional development.

- Schools and businesses should work together to support provision. A set of common standards of accreditation should be agreed between training providers.

- A viable and secure national education cloud space should be established that can be available to all schools.
Global capability

Our world has changed enormously in recent years. Few outposts of industry or commerce remain untouched by the technology revolution. The devices we take for granted in our daily lives are light years away from those we enjoyed a few decades ago. Instant global business and the deployment of a global workforce are now everyday realities. So, as the students of today become the workforce of tomorrow, we need to provide them with the skills and knowledge to take full advantage of these ever-changing opportunities: they need to know not just about today’s technologies but how to adapt to those that will come tomorrow.

Employers today want a workforce with the skills for success in a knowledge-based economy. These include:

- Self-direction and self-motivation
- Good global communication capabilities
- Capacity to carry out and share research online
- Thinking critically
- Collaboration across and between organisations
- Problem-solving
- Ability to learn

These seven areas of capability require information and communication technologies (ICT) to be effective and it is the link between these skills and ICT that provides our biggest opportunity to develop the successful entrepreneurs and global businesses so vital to our future economic success.

The recent government white paper - The Importance of Teaching¹ - cites successful developments in countries like Singapore and the Nordic countries as its inspiration. Justifiably so: through their reform of education and their embrace of the knowledge-based economy, they have seen significant economic benefits.

As part of these reforms, these countries have not only invested heavily in technology infrastructure, they have backed it up with the right policy strategy and training. Already, they have begun to reap the benefits. Indeed the World Economic Forum Global Information Technology Report 2011¹, ranks both the Asian Tiger economies and the Nordic nations highest, including Sweden (1st), Singapore (2nd) and Norway (9th), as countries that have shown ‘leadership in adopting and implementing information technology advances for increased growth and development’. The UK is ranked 15th, just below Luxembourg.

² See http://www.weforum.org/reports/global-information-technology-report-2010-2011-Q
In recent years, significant public funds have been invested in IT infrastructure, hardware and software. There has also been broad support for education strategy, ICT training for teachers and pedagogic development. Research by Becta\(^3\) has shown the UK making significant inroads into using ICT to support Knowledge Deepening – the first essential element in developing a knowledge economy (Kozma, 2005\(^4\)). Most schools now also see learning technologies as essential to the day to day delivery of high quality education; and while there is still a gap between the schools at the top end of such developments and those beginning to adopt, this gap is much smaller than many other countries. So we have a good platform on which to build.

However, that is only a necessary start in today’s fast-changing world. There is still much to do if all schools are to reach this first stage of development. A significant emphasis should then be placed on the use of learning technologies to support pedagogies that move toward the creation of knowledge - the second essential element of a knowledge-based economy, where wealth is created through our collective brainpower (Kozma, 2005). Again there are some excellent examples of this is already in action and embedded in our schools - particularly at primary level - but there need to be many more.

Schools now enjoy greater freedoms which should encourage them to seek out the infrastructure, strategies and pedagogies that will enable further development. Whilst it is right that schools are being encouraged to provide a broad base of academic education to all pupils in core subjects such as English and Maths, it is also essential that the value of technology should be recognised. There should be clear recognition in the performance tables and inspections of how effectively schools use technology to develop skills that business values and which are vital for young people in their future lives. Otherwise, there will be a widening gap between those schools who are already driving the change and those that have yet to really begin on their journey.

**Recommendations:**

- We must recognise that technology has a key role to play in education in the future - and to make this explicit in education policy. The Government should publish its technology strategy as quickly as possible, setting out a clear vision and sense of direction. Schools have the freedom to decide how they implement technology in learning, but their success in preparing learners for the global workplace – using measures agreed with industry - should be recorded in performance tables and inspections.

- It is essential that schools are provided with a means to benchmark their current position relating to ICT and to identify key areas for development. Schools should take advantage of the evolving Self Review Framework tool managed by Naace and supported by The Schools Network.

\(^3\) Becta: [http://www.education.gov.uk/aboutdfe/armelengthbodies/a00192537/becta](http://www.education.gov.uk/aboutdfe/armelengthbodies/a00192537/becta)

Qualifications

IT, ICT and computing qualifications are of particular concern, since feedback from schools and industry suggests that the current curriculum appears to isolate ICT as an option rather than making it an essential core subject. Too often, an ICT entitlement is not embedded across the curriculum and this too has an impact on how it is viewed. At the same time, a stronger technology curriculum, which could include computer science and programming, would present tech-savvy students with greater challenge and encourage them to see the potential of the creative and IT industries. A number of recent reports including the Independent Review of Skills for the UK video games and visual effects industries\(^5\) commissioned in July 2010 by Ed Vaizey MP, Minister for Culture, Communications and the Creative Industries, suggests ways forward.

Successful countries highlighted in the World Economic Forum\(^6\) report have taken steps to ensure that basic ICT is embedded into core school subjects. The argument that you can no longer teach English in modern times without the use of electronic writing skills, or that you cannot teach mathematics without use of electronic data tools, is a strong one and negates the view that ICT is an add-on, or an option in the modern world. ICT should be as much a part of everyday school life in 21\(^{st}\) century Britain as the pen and inkpot were in Victorian schools.

Many in schools and industry believe that the lack of modular structure to ICT qualifications at GCSE level and its emphasis on the use of generic ICT tools has had the effect of stifling creative development and discouraging students who would be most ideally suited to careers in pure IT or in creative spheres such as the games industry or media production. Students who grow up using computers can be challenged with computer science and programming.

There are many schools that have made excellent use of ICT across their curriculum and primary schools in particular have taken a lead in creatively embedding its use. The importance of specialist staff knowledge in enabling this cannot be underestimated. If we are to achieve the embedding of ICT entitlement across core subjects, it is essential that such specialist knowledge is retained within academic teams in schools.

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Some schools have adopted industry standard qualifications at GCSE, with successes that have resulted in an international standing for their students. The current world champion at Excel (as judged by Microsoft at its 2011 global Microsoft Office competition) is a young female student from Sawtry Community College in Cambridgeshire.

The 2011 Horizon Report⁷ suggests that ‘digital literacy is less about tools and more about thinking, and thus skills and standards based on tools and platforms have proven to be somewhat ephemeral’.

The debate around IT-related qualifications reflects this. So, there is a clear need to provide a simple route for recognition of ICT usage within core subjects and onward progression into technology-specific qualifications, or those relevant to the creative and IT industries. In addition, these should be aligned to the seven areas of capability listed earlier in this report, to ensure that as technology changes, our students are able to adapt and embed it into their working practice.

Recommendations:

- Overhaul the ICT Curriculum so that it provides both challenge and scope for creativity whilst providing a good grounding in digital literacy and computational thinking for all. Delivery could be as a discrete subject, embedded, taught and assessed within other core curriculum subjects or as some combination. A modular approach would allow progression to stand-alone IT, computing, or creative media qualifications developed with industry.

- A new technology curriculum at GCSE standard and above should be developed, including computer science and programming, to help prepare students for advanced qualifications and work in the creative industries. This subject should be given as much recognition are core subjects within the English Baccalaureate.

- Government, agencies and schools should work with industry and business to help establish a closer tie between education outcomes/qualifications and the skills needs of the modern workforce.

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The potential for e-assessment both as a means of learning and of assessing ability has been well researched in recent years and there are now quite a number of secure technology solutions, many of which have been tried and tested and are ready for implementation.

Significant research and development of teaching and professional development resources around assessment for learning has been carried out by The Schools Network in partnership with Professor Dylan William. Additionally, Intel has worked with The Schools Network to develop an online professional development tool that harnesses assessment for learning methodology to help support innovative classroom practice.

The e-Assessment Advisory Group (EAAG - formerly supported by Becta), has worked closely with The Schools Network, examination boards, technology providers and other agencies to examine the issues surrounding e-assessment and to identify potential solutions relating to summative assessment.

However, there are still problems preventing the universal adoption of e-assessment in the summative sense. The biggest is perhaps the difficulty of assessing essays in English as opposed to solving mathematics problems or scientific equations; but this is exacerbated by a series of cultural and egalitarian concerns, including conservatism within the profession and a fear that it will ‘dumb down’ exams.

Despite these problems, there have been successes in recent years, many of which can be found as case studies on the e-Assessment Association website. One notable case study from AQA cites the use of on-screen tests for science, of which, many thousands have been successfully completed.

e-Assessment in both formative and summative forms is now quite common-place in industry and has been for some years. Industrial qualifications such as those offered through the Microsoft IT Academy have a proven record of delivering high quality assessment to a global standard. While recognising the difficulties in subjects where subjective considerations may decide the marking – which can still be done online with the input of markers - more can be done to overcome the fears of those in subjects where there is the potential for much greater use of technology in assessment.

**Recommendation:**

- National standards for e-Assessment need to be established that build on the work carried out by e-Assessment Advisory Group and the e-Assessment Association.

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A number of research papers (including the recent Microsoft ITL research carried out in partnership with The Schools Network) cite poor professional development as a key element restricting change. Despite improvements, ICT is still quite often seen as an add-on to the core subjects with few perceived pedagogical benefits amongst those who see it in this way. This often results in a restricted cohort of regular participants, with the gap between the engaged and the disengaged widening.

Schools and industry have identified a number of key areas of professional development that require further support. In particular, with more Initial Teacher Training (ITT) being led by schools, it is vital that learning technology practice and strategies are given a central place in all ITT programmes. Many existing staff also require training in the effective use of learning technologies. We need more subject-specific training in ICT, computing and programming. Teachers should be encouraged to become more innovative in their use of technologies, and this can be supported with clearer IT curriculum links.

These days, professional development is less likely to take place at learning technology events or training programmes that are driven from the top down. Schools are now much more reluctant to send staff on training and new models are appearing that are proving popular with staff in schools.

The rise of teacher-led, teacher to teacher open events such as TeachMeets or Collabor8, have transformed CPD and reinforced the fact that school staff value the experience of others and the shared practice network approach is proving popular - driven by our most innovative practitioners.

At the same time, free or sponsored online webinars similar to those hosted by Classroom 2.0 are proving increasingly popular and are well attended. The advantage of such online activities is that they are not restricted by physical boundaries, with expertise from educators from around the globe being shared openly.

However, these do not address the need to support staff members who have yet to engage fully with technology and who may not be aware or have the confidence to attend a TeachMeet or the ability to participate in an online webinar.

There are other networks of practice that support these new teacher-driven professional development opportunities and which open up their work to a global audience:

- The ICT Register – www.ict-register.net - is a network of schools (with proven learning technology expertise) working together with a ‘by schools for schools’ ethos to support other schools at the stage of developing strategy and practice.

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9 See http://teachmeet.pbworks.com/w/page/19875349/FrontPage and http://www.collabor8.me
It operates online, sharing exemplar case studies and providing a means to enable rapid answers to learning technology issues via its ‘Ask the Schools’ tool. It also provides localised and bespoke professional development sessions through a core group of Advocate Schools.

- The Student Digital Leaders (SDL) network comprises students who support their schools through leadership roles allocated by the school - for example, Virtual Learning Environment coordinator, resource developer, digital reporter etc. The students are all members of a wider national and international community of shared student practice and ideas.

The demise of the Strategic Leadership in ICT (SLICT) programme, which provided guidance for school leaders on harnessing the full potential of technology, has left school leaders with fewer options when seeking to maximise the benefits of usage and value for money.

Schools are reporting a demand for leadership training in the field of learning technology and feedback from across The Schools Network suggests that this should be provided as:

- Initial kick-start training - similar to the old SLICT programme and aimed at schools that are still in the early days of developing a full learning technology strategy.
- Learning Technology Leadership modules - linked to formal leadership training or Masters qualifications.
- Research modules - designed to enable those school leaders who are already developing exemplary practice to further develop innovative practice and to publish their work.

The development of a broad provision from a variety of partners is beginning to bridge the gap. However, schools are concerned at the lack of common standards amongst training providers and would like to see a set of standards that provide for national recognition of achievement between providers when required.

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**Recommendations:**

- A variety of modular pedagogy, leadership and innovation programmes and resources should be developed to support school practitioners and leaders through every stage of learning technology development.

- A set of common standards of accreditation should be agreed between training providers.

- Practitioner-led and peer to peer professional development networks and activities such as TeachMeets should be supported through recognition and integration into formal professional development routes.

- Student leadership activities and networks should be utilised to support the development of professional practice.
Value for money

Microsoft estimates that the average school uses a million sheets of paper a year and spends £60,000 on photocopying, yet only spends around £56,000 on IT. Working electronically and reducing paper usage reaps savings that can be invested elsewhere. Simple changes like setting the default font on all school computers to the most economical or using ecc-fonts, can save over half of a school’s annual print toner costs.

The average school houses its own physical network. Each server uses electricity, generates heat and requires a network manager on site. These can now be housed virtually in the ‘cloud space’, reducing the school’s carbon footprint as well as freeing up the space required by dedicated servers and reducing the need for network management. The savings can then be deployed elsewhere.

‘In the science department, we are now scanning resources on to the VLE rather than laser printing and photocopying. It has saved £1,000 a quarter on paper, laser cartridges and general running costs, and is environmentally friendly.’

Alan Stevens
Sawtry Community College
www.sawtrycc.com

Smartphones and tablet computers are banned in many schools but a number of schools are beginning to find ways in which such devices can be safely and securely used in school. Since the majority of students have their own smartphones in many schools, there are opportunities to put them to good educational use. And fears of a digital divide due to cost can be overcome, as powerful mobile devices with internet access are becoming available in the secondhand market and phone companies are providing unlimited bandwidth in phone packages.

Student ownership of such devices will continue to grow - outpacing the ability of a school to update its own computer fleet. The impact of enabling students to use their own phones and personal technology devices in their learning has been shown to be high. The Nominet Trust’s Cloudlearn Project\(^\text{10}\) provides excellent examples of effective practice and forms the basis of an excellent source of guidance moving forward.

The power of student ICT knowledge and expertise cannot be underestimated. Student leadership has begun to influence the development of ICT strategy in many schools and those that have adopted such an approach (such as those schools who have adopted The Schools Network’s Student Digital Leaders programme\(^\text{11}\)) have seen benefits in such areas such as:

- Reduced professional development costs
- Adoption of learning technologies by staff previously reluctant to get on board

\(^\text{10}\) Nominet Trust’s Cloudlearn Project - http://www.cloudlearn.net/
\(^\text{11}\) Student Digital Leaders - https://www.ssatrust.org.uk/newtechnologies/Pages/Studentdigitalleaders.aspx
• Improved learner engagement
• Rapid growth in learning resource development.

A key concern for schools is the confusing array of provision between agencies and commercial providers with similar offers supporting the same themes and often with variable quality and content. Many school leaders argue that, whilst competition between providers is essential to ensure innovation and a competitive offer for schools, inter-agency partnership around content and related frameworks could ensure that scarce resources are better spent. It can also result in a broader, more cohesive offer to schools.

The Self Review Framework (SRF)\textsuperscript{12} is an excellent example of agencies and industry partners working together to provide schools with a framework by which they can benchmark their use of learning technologies against similar schools. The Schools Network continues to support Naace (the lead Agency) in evolving this tool.

Partnerships between industry and the education sector as a whole, can provide significant benefits. From a technology perspective, these include:

• Development of industry-specific teaching or professional development resources
• Research around specific technology uses
• Supporting innovation and encouraging next practice
• Developing new education related technologies
• Supporting entrepreneurs
• Developing qualifications and career routes
• Understanding the needs of employers and the workplace

There are many examples of such partnerships, including the Intel Teach professional development programme\textsuperscript{13}, developed in partnership with The Schools Network and its affiliated schools and the Microsoft Innovative Teaching and Learning research published in Autumn 2011.

The Schools Network has worked with a number of schools, providers and industry partners in recent years to share best practice in delivering value for money through learning technologies. Schools have suggested that there is a high demand for support programmes that assist schools to continue to develop best practice in this area and then to share it.

\textsuperscript{12} At the time of writing, still hosted on the Becta website - \url{https://selfreview.becta.org.uk/}
\textsuperscript{13} Intel Teach - \url{http://www.intel.com/about/corporateresponsibility/education/programs/intelteach_ww/index.htm}
Recommendations:

- A set of clear, suitable support standards should be adopted to enable the effective educational use of consumer technologies such as smartphones, media devices and tablet computers in schools. Excellent examples of successful practice, such as those shared within the Nominet Trust’s Cloudlearn project should be more widely shared and developed.

- A viable and secure national education cloud space should be procured that can be available to all schools at low cost.

- Schools should take advantage of programmes such as The Schools Network’s value for money in Learning Technologies programmes to ensure they are obtaining maximum return on their technology investment.

- Schools should make use of student digital leaders to help drive innovative use of learning technologies and to support practitioner professional development.

- Providers and industry partners should work together to form frameworks for support provision and should continue to support and work to evolve the Self Review Framework.
Acknowledgements

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BESA - www.besa.org.uk/

Brother - www.brother.co.uk

CISCO - www.cisco.com/uk

Connecting Learning - www.connecting-learning.co.uk

ICT Register schools – www.ict-register.net

Intel- www.intel.com

Leading Edge Schools & Academies - www.ssatrust.org.uk/achievement/

Naace – www.naace.org

Mirandanet - www.mirandanet.ac.uk

Microsoft - www.microsoft.com

Schools Network Affiliated Schools & Academies – www.theschoolsnetwork.org.uk

Smartassess - www.smartassess.com

Steljes - www.steljes.com

Toshiba - www.toshiba.co.uk

Uniservity - www.uniservity.com