

Naaace

Impacting on Learning with Technology



ADVANCING EDUCATION

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About Advancing Education

Advancing Education' is a leading journal comprised of an eclectic mix of academic and action research papers and reports from members, sponsoring partners and other expert guests on the innovative, uses of digital technologies in education. As such it reflects the wide-ranging interests of members and sponsors and all those passionate about Edtech in all phases of education. The journal is published online twice a year.



Editorial

This Advancing Education summer edition offers an impressive line-up of expert opinion from advisors, from researchers and from school leaders. We also cover the support of edtech companies for schools, Gaia Technologies. This Naace sponsor has funded a practice-based research and professional development for leaders and classroom teachers in establishing a new curriculum subject, Digital Media, in a school where they could not staff Computing. We hope more sponsors will support continuing professional development activities in the light of the challenges we face.

Meanwhile will Computing gradually disappear because not enough trained teachers have come forward? If so, this underlines the irony of the fragmentation of the school system in England presided over by a government also seeking to control schools centrally more than ever before. In fact, the government have lost control of the national curriculum because academies and free schools no longer have to teach it. Since there are also many training schools

now that train their staff in house instead of drawing from universities and employing the local authorities the sharing of professional knowledge and expertise no longer takes place as it did. Only through the professional organisations like Naace can the profession learn reliably from each other.

Not surprising in this emerging new context that our first section opens with Naace members' increasing concerns about how the new Computing curriculum has been bedding in since 2014. The second section covers teachers and advisers continuing efforts to make the Computing classroom effective and fun and looks to the implications for schools in the future of General Data Protection Regulation(GDPR).

The new Computing curriculum issues

The first issue is the lack of recruits to teach the new curriculum which is computer science focused. The Computer Science graduates who were confidently expected to rush to schools have not, in fact, been forthcoming. Last year, for the second year running, the government recruited only 70% of the 400 computer science teachers that funds allow for. Dr Bill Mitchell, head of the British Computing Society, told me that a country the size of England – with over 20,000 schools – probably needs closer to 1,000 CAS master teachers, not 400, adding that it could be another five years before teachers feel confident enough to successfully teach Computing science.

The second issue is for school business managers. Not only is there a shortage of 'qualified' teachers, but also that there's no clear definition of what 'qualified' implies. The emphasis on Computing Science has led to a devaluing of a 30 - year ICT skills' legacy; good ICT teachers have jumped ship as the message has been that their knowledge is no longer relevant. Many have been distressed by Gove's confident assertion that their teaching was 'boring'. The ICT teachers I've spoken with, who are trying to convert,

struggle with Computing because of the degree of technical, pedagogical and skill level required to teach a deep understanding of computer science. Coding programs like Python and Scratch help bridge the gap, but computer science places extra demands on teachers trained to teach ICT.

The third issue is that there are very few local authority advisers in Computing to support teachers in schools. Many Naace members who used to have this role have now set up consultancies either with their Local Authority or outside. But the reduction in funds for schools means there is little money to upgrade existing digital technologies, even less for professional development in the management and teaching of Computing.

Communities of practice like Naace continue to provide professionals with the kind of support they need through sharing with each other. Mark Chambers, CEO Naace, talks persuasively about the value of edtech, particularly in Maths and Literacy. He writes about the services that Naace offers like the 3ML Award, ICT Mark, Self Review Framework and the Naace Open Badge Academy that continue to be popular with school leaders who are still prioritising edtech. But he expresses concerns about funding and suggests that all staff need professional development in edtech as pupils have so much access outside school.

I asked Ben Williamson, Stirling University, to elaborate on a blog in which he suggested that, in fact, the advice of those who consulted on the new curriculum was ignored and two of the three strands were taken out in the weekend before the document was submitted to government. He provides much convincing detail on the fact that, "As a consequence, aspects of the curriculum emphasising 'critical evaluation of digital content,' the 'impacts' of technology on individuals and society, and 'implications' for 'rights, responsibilities and freedoms' were entirely deleted and replaced with much more computer science-based focus on the study of algorithms, Boolean logic, and data manipulation". One of the challenging questions he asks is, "Is there space in this Computing curriculum for lessons that help children understand privacy and data protection, how news circulates online, how cyberattacks and hacking affect people and institutions, how algorithms and automation are changing the future of work, how political bots threaten democracy—and how there are programmers and business plans and political agendas and interest groups behind all of this too?".

In a well-argued article, Allison Allen questions whether, in 2012, Michael Gove, then UK Education Secretary, was

right to describe the ICT curriculum as being in danger of damaging Britain's economic prospects. According to the BBC[1], Mr Gove called the ICT curriculum 'harmful and dull' and argued that the inadequate grounding in Computing offered by that curriculum was in danger of damaging Britain's economic prospects. He described children bored with being taught how to use Word or Excel by bored teachers. Allison is concerned that the current Computing curriculum is fatally restricted to computer science and will not serve pupils or business well. After researching the views of some of the largest key businesses, the central question she asks is, "Will the government and examining bodies listen to the UK's technology businesses, including those such as Fintech and Govtech that contribute most to the UK's GDP, and heed the warnings of teachers and experts to bring balance back into the curriculum for digital technology? Shouldn't we be teaching systems and design thinking along with computational thinking, allowing our future workforce to develop higher thinking skills and the ability to see the 'big picture'?" As a long serving member of the Naace Board of Management, she points out, "Naace has always believed that what we teach the children about digital technology must develop as an essential part of the school curriculum so that our learners, who will ultimately be our leaders and agents for change, understand it and are enabled to design tools for action as well as a stimulus for fresh thinking about where interventions can successfully be made".

In the face of so much criticism of Computing, school leaders can be excused for looking for an alternative. With my colleague Professor Younie from the Institute for Education Futures, De Montfort University and Bernard Dady from Gaia Technologies, I have been working with teachers as co-researchers in a school where they have had major difficulties in staffing the Computing curriculum. Added to this the new subject has been unpopular with the secondary pupils, especially the girls. In this practice based research Gaia provided significant support in the technical, organisational and leadership elements of running a two-term projects. After a visit to the Gaia Media studios that was an excellent motivator, the pupils developed digital media presentations of Blood Brothers across Music, Design and Technology and Art. In the September, three full classes opted for this Digital Media GCSE. Perhaps this is a way forward?

Theo Kuechel picks up the digital media theme by explain the ways in which Computing teachers could be introducing more visual content into the curriculum. He explains that visual culture is embedded throughout the history of

mankind through our use of technology. To make best use of these tools visual literacy develops visually fluency which allied with practical processes and skills enable us to create visual resources and artefacts. He considers Computing to be no exception despite the fact that most people think of Computing in terms of code and numbers, there is a strong visual element; either in the processes - programming and coding, or the outcomes, the visual interfaces and tools, or the latest algorithms that can identify and collect data from purely visual artefacts images. Visuality, he maintains, has been the determiner of technology and also defined how we technology.

Computing in the classroom

In the second section our experts discuss the ways in which they continue to take Computing forward. Dalian Adofo explains what has been learnt from his research into teaching the Computing curriculum in primary schools. He thinks, controversially, that the ICT curriculum was 'a dinosaur' but that Computing may end up in the same camp. He suggests, on the other hand, that 'the new curriculum presents vast opportunities for interdisciplinary learning, especially with Mathematics'. Based on how projects are devised, pupils should be able to clearly identify what other subjects are being facilitated in their learning. But he believes more research is required to understand how the child to make these connections.

Jon Audain explains how teachers can put the spark back in teaching about computers. His enthusiasm is welcome in these difficult days as he writes particularly from the perspective of young people. "Technology has always had an effect on its user. Whether it buzzes, flashes, emits a sound or illuminates, it inherently beckons its user to do something. It is important to remember that all technology has an ON/OFF switch and throughout children's development they need adults to be their filter and help them to moderate their use".

Rob Ellis draws on his advisory experience to look at the balance between online safety and online literacy. He provides a thought-provoking explanation for the reasons why we are not yet incorporating these issues into our teaching effectively. Indeed he suggests that some educators are oblivious to the dangers of the Internet. 'If there is a lack of engagement why might this be?,' Rob asks. "Lack of engagement does not imply a lack of care, rather a lack of internalised understanding. An explanation might lie in the contexts we draw on to learn. Typically our behaviours are acquired from the collective experience of society. In this instance online life is so recent a

phenomenon that the collective experience does not really exist. Children, teachers and parents can often talk about risks and dangers but are still making sense of the web themselves so that the examples they use seem detached from their reality."

Allison Allen writes about the future in e-safeguarding: an expert piece on data security and e-safety covering the new requirement of the General Data Protection Regulation (GDPR) that will soon impact on schools. This article takes a matter of fact look at the changes brought by the GDPR, school readiness, the implications of the new law and what the best schools are doing to ensure that data is safeguarded - how through pragmatic planning, schools can achieve compliance with the new legal concepts 'Privacy by Design' and 'Privacy by Default'.

Good to have some advice on an area that is outside most schools' experience. As the whole question of data becomes more complex we as educators have to find the space to understand this challenging subject.

So we hope that the readers will enjoy this edition and learn something new. I'd like to hear Naace members' views on this edition and from those who have expertise to share with members that we can publish next time.

Enjoy your holiday reading!

Dr Christina Preston, Professor of Education Innovation, The Institute for Education Futures, De Montfort University and Naace Board of Management member.

The Naace Perspective - State of the nation – well regarding EdTech in schools



*Mark Chambers, CEO
Naace, the EdTech Association.*

Falling investment in EdTech in schools

Naace members are reporting a significant fall off in the amount of investment by UK schools in EdTech; this would be less significant if it were not also matched by a marked decline in the willingness of schools to invest in the professional development of staff in regard to their effective use of EdTech in learning and teaching.

The importance of EdTech is multifaceted beginning with the fact that schools, to be relevant to their students' needs, should offer access to high quality technology resources, content and tools; this should be an entitlement for all UK students regardless of their background or ability. Naace ICT Mark and Third Millennium Learning Schools consistently demonstrate that the utilisation of EdTech provides a multiplier effect that leads to improved outcomes for young people. In the view of Naace, well managed EdTech can lead to significant savings for schools in many aspects of resourcing and can markedly improve their systems including for example, their communication process with community, parents and carers.

Naace members are also reporting that, where schools continue to invest in their staff and their competent and appropriate use of EdTech, significant gains can be achieved across the whole range of activities of the school but critically, in student achievement in English and

Mathematics. Schools that want to remain relevant would do well to look at working towards quality standards such as the ICT Mark and 3ML Award and at accreditation for Technicians, Technical Support providers and teachers that costs them nothing but time such as the Badges available in the Naace Open Badge Academy. In summary #EdTechWorks is something Naace, as a community, has been proud to assert and contribute to. But this continues to work only when schools consistently prioritise their own development of EdTech.

In this context, UK politicians have coached us into financial expectations of “cuts” and savings. Schools have to respond to this inevitability. Indeed the huge majority of school funding - 96%+ in my experience – is focussed on facilitating a human resource. As a result schools are thinking twice about buying any kind of equipment so investment in appropriate EdTech and in continuing professional development is on very few lists. This goes against the Naace conviction that a sustained investment in EdTech, matched with appropriate investment in professional development, makes sense on so many levels. In particular, if we are to see a continued improvement in outcomes for young people then we need to be moving away from the 19th century curricula, classroom organisation and pedagogy to which schools are currently retrenching. So many schools are not embracing 21st century learning in our experience.

To serve the needs of our students for a relevant and empowering 21st Century learning experience, to improve outcomes for young people and to save money for schools we need to re-evaluate our thinking with respect to EdTech and we need to urgently prioritise the professional development of all staff, not just teachers, so that we use it effectively right across our schools.

Meanwhile - regarding Computing

In contrast to the lack of investment in professional development relevant to the utilisation of EdTech in general that has been reported by members, the UK has simultaneously invested significantly in training to support the introduction of the new national Computing curriculum. This investment has been largely channelled through the BCS and their school interest groups, Computing at School (CAS) and the Network of Teaching Excellence (NoTE), with significant claims made for the scale and impact of their leadership, specifically, 14,445 teachers reached and 46,700 hours of teacher CPD. So far the focus for these efforts has been on only one third of the new curriculum, specifically, the computer science elements. The BCS

continues to lobby the UK government for more funding to pursue this aim specifically lauding the capability of university computer science departments as the essential component and capability that will transform the teaching of computer science in schools. However, this myopic focus is rapidly becoming part of the problem for the UK which is facing a growing skills gap, we are told, between the demands of the digital economy and the skill set of an emerging work force.

This year, 2017, sees the end of ICT as an advanced level qualification at GCSE and A level and the consolidation of Computer Science. Two years ago I was confidently told by Nicky Morgan, that Computer Science would replace ICT in terms of student entries but this expectation has fallen woefully short of this target, as we said it would. The current prediction of the BCS is that there will be 100,000 fewer young people with an advanced digital qualification emerging from our 16+ education system than there were just three years ago. It appears that the future of a generation has been treated as a grand experiment by those same university computer science departments, or at least some of their professors and lobbyists, who are now touted strongly by the BCS as the apparent solution.

A viable solution

Since 2010 we have been held hostage by populist politicians repeatedly reporting that Information Technology was badly taught, guilty of gamification of the system and reportedly unfulfilling for students. This was, in fact, a gross exaggeration of the situation at that time.

In fact, what was originally intended by all those invited experts involved in drafting the new Computing curriculum was that students should receive a balanced experience of Computer Science, Information Technology and Digital Literacy. More than ever now, effective professional development and further resource development is needed in all three aspects of the Computing curriculum. Those best placed to deliver this curriculum breadth is not the single

and unique perspective of computer scientists but a cross section of those involved in developing digital knowledge and skills, particularly as they are applied to the creative industries that are so important to our digital economy.

Naace members are drawn from that multi-talented community. Indeed many are leading significant and creative education technology initiatives. Together with members of like-minded international organisations like MirandaNet, ISTE and JNet, they represent a significant pool of expertise ready to support curriculum development, professional development and school. These organisations have the experience to ensure that broad programmes in three strands genuinely enable all schools to teach the full breadth of a computing curriculum that is essential for the digital age we live in.

Unlike the BCS we do not have an exclusive outlook. We do, however, continue to welcome the expertise and enthusiasm of BCS and its school interest groups if the future is to be about more than the interest of a few computer science departments at leading universities. Our vision is to provide a breadth of subject knowledge leading to a sustainable education system that makes a real and practical contribution to the digital economy, the skills and capabilities of a digital citizen and the well-being of all-stake holders in a school community.



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Coding for what? Lessons from computing in the curriculum

Ben Williamson, Faculty of Social Science, University of Stirling

Summary

The subject of computing arrived in the National Curriculum in England as the result of a diverse variety of influences, agendas and interests. This article narrates the story of how the computing curriculum came into being and teases out the different purposes that motivated diverse organizations to influence its conceptualisation and direction. The article highlights how a more social understanding of the impacts of computers on society and individuals was excluded from the curriculum at an early stage of its development as the result of political interference. This exclusion poses problems as young people are now growing up in a digital world of digital opportunities but also digital risks such as online misinformation and surveillance

Ruling machines



Recently, the role of digital technologies in everyday life and politics has become a major global concern. Topics including fake news, data mining, online surveillance, privacy invasions, hacking, cyberattacks, political bots and computational propaganda are the subjects of the news, academic research and government debate. Digital technologies, we now know, aren't just neutral tools. They can be programmed with the potential to shape people's actions, stimulate enjoyment, mediate social relationships, influence feelings, change minds, filter information, automate jobs, recommend products and media to consume, manipulate political convictions, disrupt democratic processes, and even to 'personalise' what and how people learn. Academic research on the impacts of software, algorithms and data on society are revealing that data-processing software and algorithms are becoming more powerful in our everyday lives. However, such studies also crucially acknowledge that there are people behind software, algorithms and data analysis—programmers who have learned to code to make the technologies we live with.

Within our own field, education and teaching, some have begun to suggest that children need equipping with the tools and skills to take an active part in this increasingly software-supported and automated world. Recently, for example, a profile of 'Silicon Valley's classrooms of the future' appeared in the Financial Times magazine. 'Having disrupted the world,' it claimed, 'the tech community now wants to prepare children for their new place in it. Leading venture capitalist Marc Andreessen predicts a future with two types of job: people who tell computers what to do, and people who are told what to do by computers. Silicon Valley wants to equip young people to rule the machines.'

As a result, Silicon Valley companies are now investing billions of dollars to re-engineer public education to enable people to rule the machines. One such effort, according to Natasha Singer writing in the New York Times, is the learning to code organization Code.org, 'a major non-profit group financed with more than \$60 million from Silicon Valley luminaries and their companies, which has the stated goal of getting every public school in the United States to teach computer science. Its argument is twofold: students would benefit from these classes, and companies need more programmers.' According to Singer's follow-up article in the New York Times, the learning to code movement is a key way that Silicon Valley companies and entrepreneurs are staging a commercial takeover of public education. 'Code.org has emerged as a new prototype for Silicon Valley education reform: a social-media-savvy entity that pushes for education policy changes, develops curriculums, offers online coding lessons and trains teachers—touching nearly every facet of the education supply chain,' argued Singer.

However, it's not just in Silicon Valley that this enthusiasm for teaching children to 'rule the machines' has taken hold. Across the world, children are being told they must 'learn to code.' Governments in Europe, the Americas, Asia, Australia and New Zealand have all begun to introduce computer programming and computer science into school curricula. In England, the new subject of computing appeared in 2013, and the English example is now something of a global prototype that other countries are watching with interest. Over the last couple of years, I've been studying the documents produced to promote learning to code in England, following how coding and computing have been embedded in the curriculum, and recently interviewing relevant policy influencers involved in the new computing curriculum. In our recent interviews, we've been trying to work out why various influencers want computer programming in schools—what are the purposes of learning

to code in the curriculum? In other words, 'coding for what?' And we've been trying to piece together the policy narrative, and to uncover the influences involved in shaping the direction of the computing curriculum.

The business of curriculum politics

England was the first country in the world to formalise computing and programming in its curriculum for schools in 2013. The key catalyst was a speech in 2011 by Eric Schmidt, then the chief executive of Google, at the Edinburgh Television Festival, during which he attacked the emphasis in UK schools on teaching students to use information and communication technology (ICT) applications.

'In the 1980s the BBC not only broadcast programming for kids about coding, but (in partnership with Acorn) shipped over a million BBC Micro computers into schools and homes,' Schmidt said. 'That was a fabulous initiative, but it's long gone. I was flabbergasted to learn that today computer science isn't even taught as standard in UK schools. Your IT curriculum focuses on teaching how to use software, but gives no insight into how it's made. That is just throwing away your great computing heritage.'

The speech resonated with growing concerns at the time with the subject of ICT in the National Curriculum in England. In fact, within six months of Schmidt's speech, the Secretary of State for education in England at the time, Michael Gove MP, announced the complete disapplication of ICT during his own speech at a 2012 technology trade show for teachers, BETT. In his speech Gove referenced a National Curriculum Review Call for Evidence in which the British Computer Society, Computing at School, eSkills UK, the Royal Society, and even Naace all called the current National Curriculum for ICT unsatisfactory, and then spelled out what he planned to do about it.

'I am announcing today that the Department for Education is ... withdrawing the existing National Curriculum Programme of Study for ICT from September this year,' said Gove. 'The traditional approach would have been to keep the Programme of Study in place for the next 4 years, while we assembled a panel of experts, wrote a new ICT curriculum.... We will not be doing that. Technology in schools will no longer be micromanaged by Whitehall.'

Following the speech, the Department for Education embarked on a period of consultation to work out how it would reform ICT. The inspectorate for schools, Ofsted, also undertook a highly critical review of the subject.

It is tempting to see Gove's speech, just months after Schmidt's attack, as an example of commercial aspirations driving government decision-making. One of the interviewees we spoke to about the new curriculum said, 'Would you have got the attention of Michael Gove without Google or Microsoft government relations? I don't think you would. You wouldn't reach that level of policymaking.'

But actually it's not as straightforward as business driving curriculum policy. What happened in England with computing in the curriculum was the result of a much messier mix of ambitions and activities including government, businesses, professional societies, venture capitalists, think tanks, charities, non-profit organizations, the media and campaigning groups. As another of our interviewees said, from the outside the new curriculum looked 'sudden and organised' but was actually a more 'anarchic' mess of 'passions' and 'reasons'.

Anarchic passions



The year before Eric Schmidt's Edinburgh speech, in summer 2010, the campaigning organization Computing at School had already produced a white paper detailing a new approach to computing teaching. Computing at School (CaS) is a teacher members' organization, a formal partner of the British Computing Society (BCS, otherwise known as the Chartered Institute for IT) and is chaired by a senior Microsoft researcher. CaS is financially supported by the BCS, Microsoft, Google, Ensoft and the UK Committee of Heads and Professors of Computer Science, with a board including academic computer scientists, computing educators, and industry representatives from Microsoft. Its 2010 white paper focused on 'how computers work,' the knowledge and skills of programming, and 'computational thinking'—that is, it said, a 'philosophy that underpins computing' and a distinctive way to 'tackle problems, to break them down into solvable chunks and to devise algorithms to solve them' in a way that a computer can understand.

One of the other key groups seeking to influence computing in schools prior to the two speeches was Nesta, a think tank for innovation with particular focus areas on the creative industries, digital economy, and digital education. In 2011 Nesta oversaw a review of the skills requirements for the videogames and visual effects industries in the UK. The Next Gen review was first commissioned in summer 2010 by Ed Vaizey MP, then the Minister for Culture, Communications and the Creative Industries. The public figurehead for the review was the digital entrepreneur, Ian Livingstone, the chair of Eidos Interactive games company, and then the government's 'Skills Champion.' The research and the published report and its policy recommendations, however, were developed by in-house Nesta staff. Nesta also produced a 2012 report on the legacy of the BBC Micro that Eric Schmidt had credited as a 'fabulous initiative' to get UK children coding in the 80s.

Soon after the Next Gen report was released, Livingstone and Nesta formed a pressure group, the Next Gen Skills campaign, which lobbied government hard to introduce programming and computer science into the curriculum. The campaign was supported by Google, Facebook, Nintendo, Microsoft, and was led by the interactive games and entertainment trade body UKIE. The BCS added a letter of support for Next Gen which was then sent to Michael Gove. The letter was additionally signed by Google staff who had been involved in Next Gen during the research phase, who then also briefed Eric Schmidt ahead of his Edinburgh TV Festival keynote. According to a Nesta retrospective of the Next Gen report and campaign: 'Since its report launched five years ago, Next Gen has influenced policy, rallied industry and galvanised educators to improve computer science teaching. The story is proof of the importance of building a rigorous evidence base on which to formulate policy, and the power of partnerships in affecting policy change. It has paved the way for a new generation of coders to reclaim our great computing heritage.'

At about the same time as the Next Gen campaign was lobbying Michael Gove and the DfE, the Royal Society was also working on its own review of computer science education in UK schools. Its report, *Shut Down or Restart?*, was published just days after Michael Gove's speech in January 2012. Its emphasis was on the idea of computing at the 'fourth science' in the English computing curriculum and reflected the interests of academic computer scientists rather than the industry interests of Nesta's Next Gen. Nonetheless, BCS and CaS, Nesta and the Royal Society between them appeared to have found common ground between their various interests.

Curriculum consultation & conflict



Given the diverse sources of influence on computing in schools, however, it was probably inevitable that conflict about the shape and direction of the new subject would emerge as it was formally developed.

In the months following Michael Gove's speech, members of Computing at School began attending consultation meetings for the ICT curriculum organised by the DfE, where they were able to lobby civil servants about computer science as a school subject. As a consequence, its white paper, and the outline computing curriculum it then produced in March 2012 (with the endorsement of BCS, Microsoft and Google) was taken forward as a suggested blueprint for the new subject. The Department for Education then formed a working group to design draft programmes of study for the new subject. The working group was led by the British Computing Society, the Royal Academy of Engineering, and Computing at School, with membership that encompassed interests from industry, education and academia. The Computing at School chairperson was appointed by the Department for Education as head of the working group to oversee the development of the new curriculum, which consisted of a 3 month process of stakeholder consultation, debate and drafting in autumn 2012.

Although in the interviews we conducted some members of the working group reported a harmonious period of discussion and drafting, characterised by a high degree of consensus and agreement, other members described more discontent and heated debate. High-level terminology for the new subject was especially divisive, with some favouring an emphasis on ICT, others on computer science, and other prioritising digital literacy. An original high-level draft of the curriculum—which the DfE had demanded consist of no more than two sides of A4 paper—seemed to solve the disagreement by focusing on three core concepts of 'Fundamentals' (computer science and software), 'Applications' (using ICT), and 'Implications' (digital literacy, the role of technology and impact on society and e-safety). However, this draft was rejected which resulted in a further round of redrafting and consultation, and eventual submission to the DfE late in 2012. At this point, the government minister and special advisor then responsible for overseeing the new subject demanded further changes which most notably included a much greater emphasis on

computer science concepts rather than aspects of ICT and digital literacy which had until then been retained.

Controversially, according to some accounts from participants in the working group, two senior BCS members were charged with rewriting the curriculum over a single weekend, which involved renaming the subject as computing without any consultation with the original working group. As a consequence, aspects of the curriculum emphasising 'critical evaluation of digital content,' the 'impacts' of technology on individuals and society, and 'implications' for 'rights, responsibilities and freedoms' were entirely deleted and replaced with much more computer science-based focus on the study of algorithms, Boolean logic, and data manipulation. According to the interviews we conducted, when the computing curriculum consultation group submitted its draft in late 2012, 'The exact words were 'the minister is not minded to approve the draft you sent,'" one interviewee told us. The group had submitted its draft curriculum at 5 o'clock on a Friday evening and the chair was then contacted over the weekend by the special adviser to the minister. Our interviewee then described how he called the working group chair to ask, 'are we going to reform the drafting group...? And the answer was, "No, we've already done it. We were told unless we got it back to the minister by 9 o'clock on Monday morning with a greater emphasis on Computer Science, then computing would not be in the national curriculum."'

The interference in the consultative process by a ministerial special adviser over a single weekend represents a decisive moment in the shaping of computing as it was introduced into the curriculum. It was not a popular decision among all members of the working group. One of the people we interviewed, also part of the curriculum consultation and drafting group, told us he was even banned from attending meetings after complaining about there being too much Computer Science content. Another had his expenses cancelled as part of the group to stop him doing wider consultation with teachers. The minister's special adviser was allegedly behind both decisions.

Geek insiders

The role of charitable, non-profit and voluntary groups focused on teaching children how to program computers in out-of-school settings was significant in demonstrating how computing might be approached in practice in the classroom. Some members from these groups had already helped the DfE understand the possibilities of coding in schools during the consultation period for the curriculum, by acting as 'geek insiders' (as one of our interviewees

characterised it) who could translate the language of the technology sector into the language of government.

Organizations such as Young Rewired State with its Festival of Code event, the Raspberry Pi Foundation (the charity set up to support the educational uses of the small, 'hackable' Raspberry Pi device) and Code Club, an after-school programming scheme run by volunteer computer programmers, all helped to demonstrate what might be possible within the new curriculum.

With the announcement of computing in the curriculum, some of these organizations began to focus on teacher training to prepare practitioners to teach the subject. Code Club established Code Club Pro, where volunteer programmers educate primary school teachers in how to teach programming themselves, while the Raspberry Pi Foundation established the Picademy for free teacher training. Code Club was also absorbed into the Raspberry Pi Foundation in 2015 as part of a partnership to catalyse the wider uptake of computing in schools. The Raspberry Pi Foundation also began publishing the Hello World magazine to focus on 'plugging gaps' in teachers' knowledge and skills in computer science and programming.

Perhaps the most high profile intervention into coding in schools was the launch of the BBC nationwide campaign Make It Digital in 2015. Make it Digital was intended to capitalise on the legacy of the BBC Micro and the BBC Computer Literacy Project that accompanied it in the 1980s, and help build the UK's digital skills through a variety of new programmes, partnerships and projects. One of the key projects was the launch of the BBC micro:bit, a small coding device which it distributed for free to a million UK schoolchildren in 2016. Although it did not appear until 2016, the micro:bit had a much longer gestation, with an initial period of public consultation about the possibility of a new BBC Micro Project led by academics at Manchester Metropolitan University in partnership with the BBC in 2011. The design, manufacture and distribution of the micro:bit was enabled through 29 formal partnerships agreed with, among others, ARM, Barclays, Lancaster University, Microsoft, Samsung, Technology Will Save Us, and 'formal product champions' including Cisco, Code Club, CoderDojo and the Open University in outreach, engagement and educational resources.

Follow the money



Commercial organizations took forward computing and coding with enthusiasm. There were clear perceived commercial benefits for those for-profit companies that provide resources for programming. The chief executive of the online coding provider Codecademy, for example, claimed to have ‘struck oil’ when the new subject was announced as it was ‘forcing an entire generation to learn to code.’ The US organization Code.org launched the Hour of Code in the UK in 2014, with public endorsement from then-Mayor of London Boris Johnson, Tim Berners-Lee, Ian Livingstone and the chairman of Computing at School. In the same year, the Year of Code campaign was established in January 2014 to help people ‘learn code and create exciting things on computers.’ Year of Code was chaired by Rohan Silva, a former senior policy advisor to Prime Minister David Cameron, and an ‘entrepreneur-in-residence’ at Index Ventures, an international venture capital firm dedicated to technology entrepreneurship. As The Observer technology columnist John Naughton noted, ‘Year of Code is a takeover bid by a corporate world that has woken up to the realisation that the changes in the computing curriculum ... will open up massive commercial opportunities.’

Notably, the computing curriculum has led to some significant public-private funding arrangements. In early 2015, the new Secretary of State for education, Nicky Morgan announced £3.6million ‘to launch top technology experts—from firms including O2 and Google—into schools up and down the country to help prepare England’s primary school teachers for the new computing curriculum.’ As part of the package, Morgan announced that the DfE would provide the BCS with more than £2 million to set up a network of 400 ‘master teachers’ to train teachers in other schools and provide resources for use in the classroom; £1.1 million to Computing at School to help train primary teachers already working in the classroom through online resources and school workshops; bursaries for those wanting to become computing teachers; and the introduction of computing teacher training scholarships of £25,000—backed by Microsoft, Google, IBM and Facebook—to encourage more graduates to become computing teachers. These funding arrangements were made as part

of the DfE’s Computing Matched Fund, first trialled in 2014 with £500,000 from the DfE and involving matched funding agreements with Microsoft, Google, academic departments, private philanthropists, and organizations including BCS, Computing at School and Code Club.

Though the introduction of computing in the National Curriculum applies only in England, the other devolved governments of the UK have similar aspirations for the new subject. In Scotland, computing science is already available as a national qualification subject in the Curriculum for Excellence, coding is an optional part of the ICT curriculum in Northern Ireland, and in 2017, Wales announced £1.3million funding for schools to set up coding clubs, as a route towards the introduction of computing in the Welsh curriculum in 2021. Thanks to fairly significant levels of commercial investment and some government funding, computing is now established across the UK.

Five years after Eric Schmidt’s speech, Google was far more enthusiastic about the state of computing in UK education. In late 2016 Google revealed plans for its proposed new London headquarters, the enormous ‘landscaper’ building it plans to build next to King’s Cross railway station. ‘Here in the UK, it’s clear to me that computer science has a great future with the talent, educational institutions, and passion for innovation we see all around us,’ said new Google chief executive Sundar Pichai. ‘We are committed to the UK and excited to continue our investment.’

Gains and losses

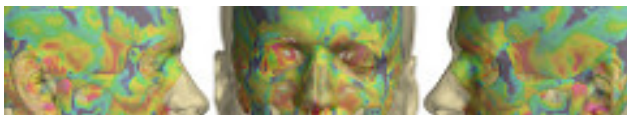
Over a period of just a few years, a lot has been accomplished. England has a new subject in the National Curriculum. Startup companies and charities staffed by volunteer programmers are playing a stronger role in educating young people and training teachers in coding. Respected institutions have managed to lobby government successfully. A million children have been given a micro:bit. Money is being spent, and made. Global commercial technology companies have got closer to education policymaking. Entrepreneurs such as Ian Livingstone are setting up their own schools to enact their visions of the future of education. As a result, England’s experiment with computing in the curriculum is being treated as a prototype for other countries to emulate.

Much has been lost along the way, too. There is now evidence that fewer girls and children from lower socioeconomic groups are choosing to study computing at GCSE than was projected, which the BCS sees as ‘a disaster for our children, and the future of the nation.’ With

the academisation of schools in England and greater freedoms over the curriculum, there are also concerns that schools without fully trained teachers could just drop computing altogether. More subtly, any sense of the differentiation between 'computing,' 'computer science' and 'programming' has been lost too. Government ministers and special advisers may have demanded more computer science emphasis, but the common references to learning 'code' tend to treat the subject more like software engineering and the creation of artefacts with value in themselves rather than the study of algorithms and computation.

Maybe too, then, computing in schools has been overly influenced by the interests of entrepreneurs from technology campuses in Silicon Valley, whose agendas are to cultivate more software programmers, and many of which aspire to a worldwide reshaping of public education to become more technology-led and less micromanaged by government departments. And finally, a significant loss from the computing curriculum is a more social and critical understanding of the impacts of computing on society.

Toward critical computing



Late in 2016 Oracle, one of the world's largest business software and database vendors, announced it would fund European Union member states \$1.4 billion dollars to advance computing and programming in schools through Oracle Academy, its global philanthropic arm. This is part of its ambition to spread computer science education around the world. It claims to have impacted on 30 million students in 110 countries already, mostly through retraining teachers, and annually invests \$3.3 billion to 'accelerate digital literacy worldwide.' Most notably, in Europe, Oracle is seeking to 'Level Oracle Academy's entire curriculum to the European Qualifications Framework.' This makes Oracle potentially very influential in European computing education. A European Union spokesperson said of the deal, 'Digitally skilled professionals are critical to Europe's competitiveness and capacity for innovation. Over the last ten years, we've seen the demand for workers with computer science and coding skills grow by four percent each year. Oracle's efforts to bring computer science into classrooms across the European Union will help strengthen our digital economy.'

However, Oracle is not just a charitable provider of funds for computing teacher training around the world. Recently,

Oracle was one of the key organizations identified in a report by the Austrian research group Cracked Labs on the commercial data and surveillance industry. It demonstrated how we are being tracked and profiled via data collected from our use of telecoms, the media, retail, finance, social media and technology platforms, and public services. As one of the world's biggest data companies, Oracle's 'data cloud' contains detailed information about 2 billion people, which it uses to profile and sort, find and target people, sell data, personalize content, and measure how people behave. As the outspokenly critical programmer Maciej Ceglowski has said, 'an enthusiastic group of nerds has decided to treat the rest of the world as a science experiment' by creating 'the greatest surveillance apparatus the world has ever seen.'

This is the kind of digital environment that children and young people are now living and learning in. That's why a serious discussion is required about a different, more socially and critically-focused direction in coding and computing in the curriculum. Otherwise we risk reproducing the commercial values of technology companies inside the classroom, or even educating 'enthusiastic nerds' who are blind to the negative side effects of the programs they write.

As the philosopher of technology Ian Bogost has commented, 'Not all students in computer-science programs think they'll become startup billionaires... But not all of them don't think so, either. Would-be "engineers" are encouraged to think of every project as a potential business ready to scale and sell.' The commercial culture of computing that is creeping into computer science courses, he has added, downplays the social consequences of software engineering decisions while emphasising 'speculative finance.'

There is also a risk that young people are being taught how to program computers without being taught about the social consequences of technology development. It is notable that when the co-founder of Code Club criticised the 'mass surveillance' practices of Google a few years back that she was forced to resign by the Code Club board. Google was then one of Code Club's main commercial sponsors. 'We should not accept that privacy no longer exists, just because corporations doing mass surveillance also teach kids to code,' she said. 'I cannot stay silent about large corporations infringing on human rights, and I believe it is my moral obligation to speak out against it.'

Commercial companies like Google and Oracle have become some of the world's most generous donors to

computer science and coding courses. But they are also deeply concerning organizations with huge powers of data-based surveillance and capacity to intervene in people's lives through measuring, profiling, sorting, and targeting them through the digital data traces that are produced when lives are spent connected to the internet. Some critics are already arguing that learning to code is a distraction from learning 'values filters so our children can interact in this environment.' The House of Lords recently issued a similar assessment of British education, claiming it does not adequately prepare children to 'thrive online.'

What would it mean to receive an education in computing that helped young people navigate life in the algorithmic data cloud in an informed and safe way, rather than as passive subjects of the vast science experiment designed by the enthusiastic nerds of the commercial technology sector? Is there space in the computing curriculum for lessons that help children understand privacy and data protection, how news circulates online, how cyberattacks and hacking affect people and institutions, how algorithms and automation are changing the future of work, how political bots threaten democracy—and how there are programmers and business plans and political agendas and interest groups behind all of this too. Computing educators need to remember that computing technologies and the programmers and project managers that built them are often thoroughly enmeshed in politics. Learning to code and knowing how computers work from a computer science perspective will not help young people understand the power of computers and of the programmers that 'rule the machines' to also rule the ways that millions of people live their lives.

It is time to consider a more socially aware and critical computing education that could engage with the social and political power of code to engineer, in part, how we live and think. That type of study of computing and its impacts and implications was shut down before the curriculum had even started up.

What should we teach the children?

Allison Allen, Director, Outstream Consulting

Allison is a Governor and the Chair of Standards Committee with responsibility for monitoring SEND and Assessment and Outcomes at Heathfield & La Fontaine Academies which are part of the STEP Academy Trust. She is also the Naace pro bono Online Safety Lead, SRF e-Safeguarding and Curriculum Framework Review Groups Lead and Past Trustee.

Summary

In 2012 the UK education secretary described the ICT curriculum as being in danger of damaging Britain's economic prospects. The new computing curriculum draft that followed, appeared exciting and defined the information technology aspect as "covers the use and application of digital systems to develop technological solutions purposefully and creatively", while computer science "explains how computer systems work, how they are designed and programmed". The ICT curriculum was summarily scrapped and in 2014, Computing became the replacement. The programme of study had high aspirations "...a high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world."

However, there appeared such emphasis on programming in the new curriculum, to the detriment of other aspects that Naace warned; "The current emphasis on programming, and especially on coding, which is only the last step in a long problem solving process, is actually a substantial overemphasis, and it is essential that schools maintain a broad, balanced Computing curriculum, as they should do for the curriculum as a whole". A study undertaken by the London School of Economics on behalf of the technology charity Nominet Trust warned, "The link between learning to code and employability is unproven and unclear".

This article considers evidence about whether the Computing curriculum is still fit for purpose – in particular if it supports learners to develop not only the life skills needed for this technological age, but also the skills still desperately needed in the business workplace.

A very few years ago when the subject representing the digital technology curriculum in schools in England was

called Information and Communication Technology (ICT for short), our best schools were delivering engaging, challenging lessons to learners, that gave them real-life skills and importantly the skills needed by employers in business, industry, commerce and engineering. These skills included not just user skills and team-working, but the higher thinking skills of problem solving, project management, designing systems for others use and user-centred design principles from which thousands of "apps" are made and indeed the charity 'Apps for Good' developed. Learners were empowered to become employees, or leaders who saw the big picture, who could work as teams and who were according to Naace's curriculum framework "digitally savvy".

Higher thinking ICT skills included the development in pupils of detailed knowledge and understanding of hardware and software, including integrated circuits or microchips, algorithms, programming and curiosity to see what could be made and how human reach could be extended by technology. They understood basic project management and used systems design principles and user-centred design to create systems to fulfil a task or solve a problem. Many of the best schools used a Project Based Learning

approach, where students work for an extended period of time to investigate and respond to an authentic, engaging and complex question, problem, or challenge – so

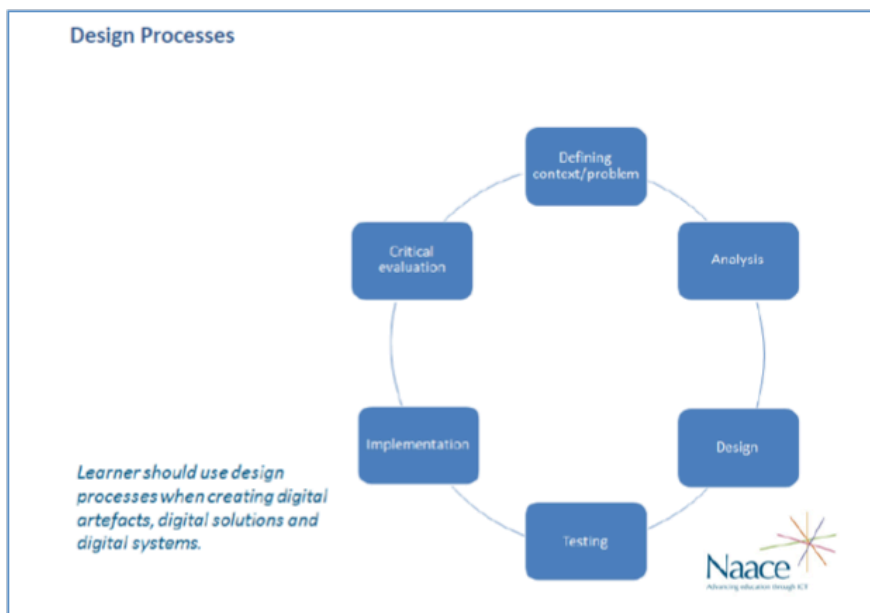


Fig1. Systems design process from the Naace ICT Curriculum Framework

developing deep knowledge and skills.

To the bewilderment of many education technology professionals, in 2012 Michael Gove, then UK Education Secretary described the ICT curriculum as being in danger of damaging Britain's economic prospects. According to the BBC, Mr Gove called the ICT curriculum 'harmful and

dull' and argued that the inadequate grounding in computing offered by that curriculum was in danger of damaging Britain's economic prospects. He described children bored with being taught how to use Word or Excel by bored teachers.

In 2012 The British Computer Society (BCS) and the Royal Academy of Engineering (RAE) coordinated the

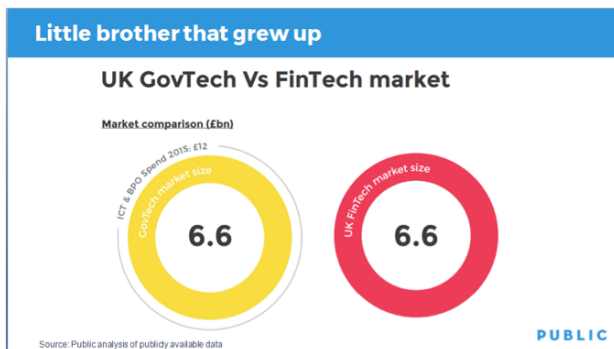


Fig 2. Systems design process from the Naace ICT Curriculum Framework

development of a draft ICT Programme of Study (PoS) at the invitation of the Department for Education (DfE). This draft represented the expert advice of a working party that coordinated input from a range of stakeholders including Naace and the resulting draft was later named "Computing". The draft was exciting, clearly including Computing Science, Information Technology and Digital Literacy (with safety); it defined the Information Technology aspect as "covers the use and application of digital systems to develop technological solutions purposefully and creatively", while Computer Science "explains how computer systems work, how they are designed and programmed". The old ICT curriculum was summarily scrapped and in 2014, a revised version of Computing became the replacement. The programme of study had high aspirations "...a high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world."

Naace explained that a key outcome from the Study of Computing is that pupils can make, test and refine a digital artefact for a specific purpose and with a specific audience in mind. So the essence of the assessment of Computing should be a consideration of the fitness for purpose of a digital artefact. However, there appeared such emphasis on programming in the new curriculum, to the

detriment of other aspects that they warned; "The current emphasis on programming, and especially on coding, which is only the last step in a long problem solving process, is actually a substantial overemphasis, and it is essential that schools maintain a broad, balanced Computing curriculum, as they should do for the curriculum as a whole".

A study undertaken by the London School of Economics on behalf of the technology charity Nominet Trust warned, "The link between learning to code and employability is unproven and unclear".

Many educators and businesses are very interested in how successful the Computing curriculum is in better developing the skills that are so needed in business to ensure that the UK maintains its competitive lead in the technology marketplace. In fact, the UK's digital economy is world leading in terms of proportion of GDP contributed and the Internet economy in the UK, which includes online retailing, sales of Internet-related devices, IT and telecommunications investments, and Internet-related government spending, is expected to grow to more than £200 billion over the life of the government.

The Digital Leaders 12th National Digital Conference 2017 - Leading Digital Transformation (DL17) took place earlier this summer with highly influential and well-informed speakers from business and government. There were some surprising messages for government, for those teaching technology in schools and the success of the Computing curriculum:

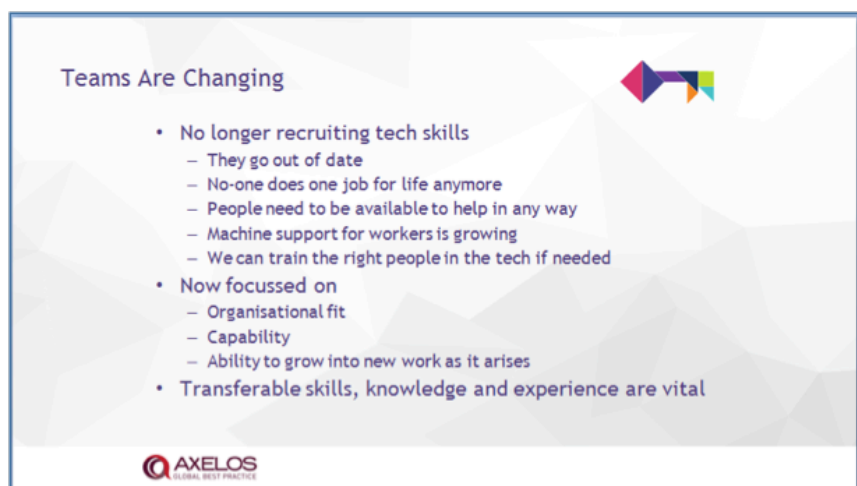


Fig 3.. The workforce we need now @AXELOS_GBP

Cameron Stewart, Head of PPM Product Development at AXELOS, described issues in recruitment with a message (subsequently broadcast by the audience across social media), explaining that technology businesses are no longer recruiting people with technical skills including programming

because they go out of date and moreover, they need people that understand the importance of relating to the user rather than the product.

The business world, he said, needs people with transferable skills, knowledge and experience. In addition research outcomes with partners had shown 76% believe project management will become a basic business skill. In his vision, Cameron articulated that “We’re leaving the Industrial Age ... This is probably the “Network Age”... .. or it might be the “Social Age”” and “Rise of AI”

Mayank Prakash, Director General, Digital Technology, Department for Work and Pensions (DWP) was more forthright in his interview. DWP delivers services for 22 million citizens – a scale larger than other government departments and FTSE100 companies. Despite all the necessary coding (50 million lines), the approach of DWP is

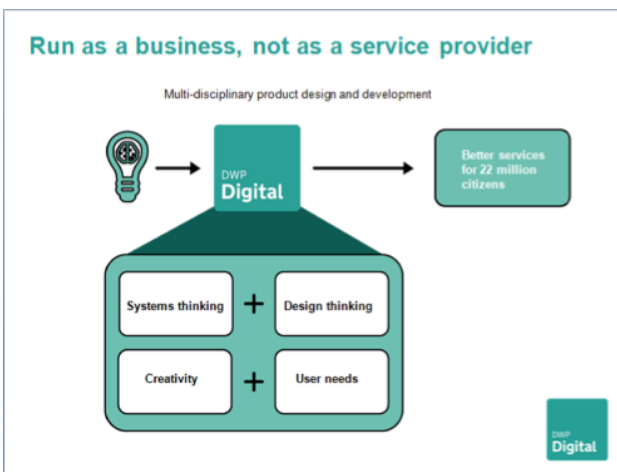


Fig 4. Systems design process from the Naace ICT Curriculum Framework

one of “Systems thinking plus Design thinking and Creativity plus User needs”. This point was reiterated again and again as he emphasised the need for systems thinking and design thinking in the DWP workforce.

Nick Williams, Managing Director, Consumer and Commercial Digital, Lloyds Banking Group, described the Challenges to Growth for Digital Business which include the economic challenges leading to technology-driven customer innovation and cost reduction, the struggle for finance and insurance companies without making a significant business model choice and ‘Digital Shadows’ – the risk of people being turned off or rejecting digital – in the face of 11.5m (21%) people that still don’t have basic digital skills and 45% of people rely on peer support of friends and family, making user-centred design and trusted faces a high priority.

It seems on balance that the curriculum has perhaps moved too far from the core of ICT – the business world indicates

that schools are focusing too strongly on coding and programming without developing systems, design and user-centred thinking alongside computational thinking.

Apps for Good runs creative learning programmes in which students confidently use new technologies to design and make products that can make a difference to their world. They issue a clear warning that education systems are needlessly wasting talent and that many young people are de-motivated by traditional teaching methods which leave them ill prepared for the real world. They say that although technology is advancing rapidly - exciting young people, who want to use it to make, play and share - traditional teaching misses this opportunity to engage, especially those students most disaffected with standard lessons. Teachers who want to use technology to create more exciting ways to learn feel frustrated they cannot do more.

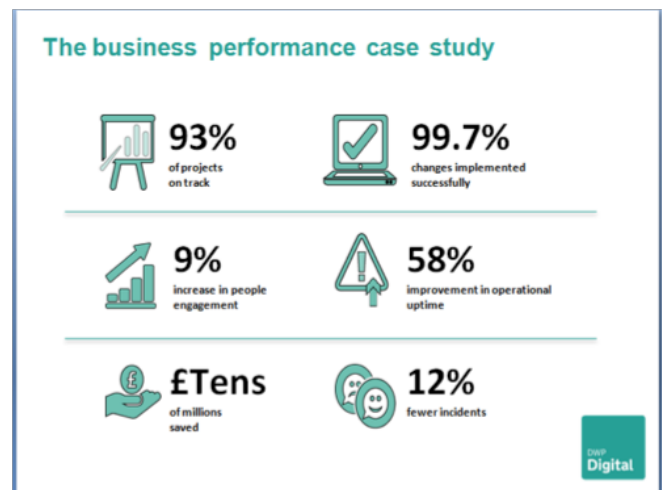


Fig 5. Systems design process from the Naace ICT Curriculum Framework

Debates on education forums describe teachers who are unhappy with the amount and difficulty of graduate level knowledge of programming and computing that they are required to teach to 14 year olds. The loss of systems design and project based learning is demoralising the workforce and teachers are leaving the profession with concomitant difficulty in recruitment of teachers with the necessary expertise. Schools are cutting the Computing Science option due to lack of take-up and questions over suitability and in some cases reducing Computing in KS3. In general there is more engagement in the Primary sector, but problem solving skills, higher thinking and digital literacy are seriously neglected in favour of programming with Scratch. Given the nature of our technological world, this seems a gross disservice to our pupils.

Individual teachers have undertaken research showing problems such as less able pupils put off by the more

Computing Science and programming aspects of computing and miss the application of ICT to problem solving while more able pupils don't see how Computing Science or Computing and their focus on Python programming can be relevant to careers in STEM or law for instance. There are confused messages about the value of Computing Science GCSE compared to Maths or Science and the over emphasis on Coding and programming and a lack of Digital literacy, hardware, and systems or computational thinking leads pupils to think that more or less programming is all there is with no IT, problem solving and digital literacy. Teachers have recently accused the government of deliberately holding back approval for new ICT qualifications to force more pupils into the "harder" computing GCSE as they wait in July for news of what needs preparation for September delivery.

Tom Goodwin in his article on Education for GQ magazine, articulates the dilemma - if we accept that the role of education is to furnish our children with the best understanding, skills and values for a prosperous and happy life, then how do we arm them for a future that we can't imagine? He reminds us that a 5-year-old today will enter a working world in 2030 that is so incomprehensible that we need an existential re-imagination of the very foundation of education. Many educators are thinking that teaching children to code is the solution, but the question is if software will soon be written by software? Our vision for the future needs to include more imagination. He questions how much the world has changed, and how little education has. The digital age means a different world.

The question must be – will the government and examining bodies listen to the UK's technology businesses and heed the warnings of teachers and experts to bring balance back into the curriculum for digital technology? Shouldn't we be teaching systems and design thinking along with computational thinking, allowing our future workforce to develop higher thinking skills and the ability to see the 'big picture'?

Naace has always believed that what we teach the children about digital technology must develop as an essential part of the school curriculum so that our learners, who will ultimately be our leaders and agents for change, understand it and are enabled to design tools for action as well as a stimulus for fresh thinking about where interventions can successfully be made. Digital technology could be one of the most powerful enablers of transformation we possess; with excellent teaching and intelligent use of the curriculum, our pupils have the ability to support the change needed by

taking good ideas to a scale that fundamentally alters the way we live.

2017

The Golden Triangle

Schools working with industry and researchers on effective professional development programmes about digital technologies in classrooms.

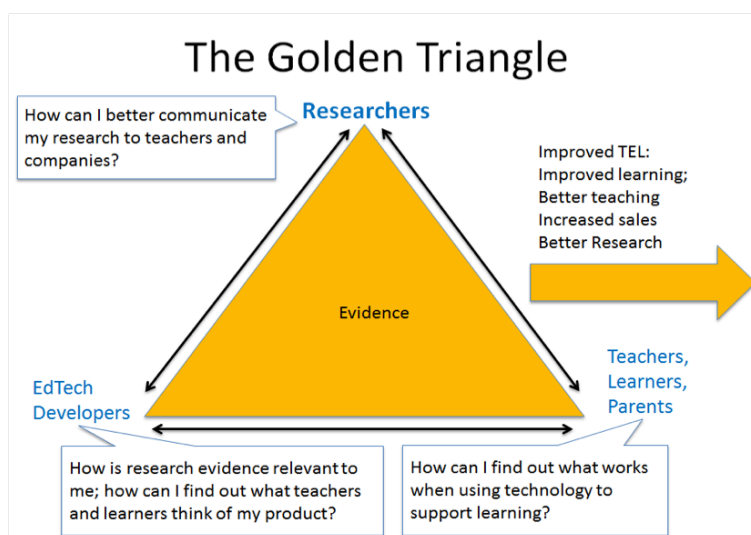
Professor Christina Preston and Professor Sarah Younie ,
MirandaNet Fellowship ,

The Institute for Education Futures,
De Montfort University.

Summary

This article covers a practice based research project in a school that was struggling to staff the new Computing curriculum and dealing with the diminishing popularity of the subject especially amongst girls. A key question in their study was to establish whether introducing Digital Media studies across drama, art and music might be a viable alternative to Computing. The leaders felt that the quality of the findings was derived from strength of the partnership between the researchers from the MirandaNet Fellowship , researchers from Gaia Technologies , a MirandaNet associate company, and the teachers and leaders as co-researchers from the school. At the end of the first year the leaders had a sustainable plan for changing their policy and practice with digital technologies as a result of what they had discovered.

Figure 1: The Golden Triangle of Collaborative Evidence-based Product



Design (Luckin, 2016)

The edtech context

The use of educational technology in teaching and learning in schools in the UK reached its peak in the early 2000s. Since the disapplication of the Information and Communications Technology curriculum by the government in 2012 and the introduction of the Computing curriculum in 2014 there has been confusion about what to teach, a lack

of trained teachers to lead the more rigorous Computer Science elements of the Computing curriculum, a concern about the lack of girls choosing the subject and about the absence of funding to support this expensive area of learning (Younie and Preston 2017). In this edition of the Advancing Education journal, Williamson provides an insightful analysis of the context in which edtech professionals are now working. He highlights how a more social understanding of the impacts of computers on society and individuals was excluded from the curriculum at an early stage of its development as the result of political interference.

“This exclusion poses problems as young people are now growing up in a digital world of digital opportunities but also digital risks such as online misinformation and surveillance” (Williamson 2017).

The Golden Triangle partnership

A study of the introduction of commercial providers of Continuing Professional Development (CPD) in digital technologies was researched in a 2011 government study (Pachler, Preston, Cuthell, Allen and Pinheiro Torres). The findings were not encouraging. A general problem was that training for teachers in digital technologies was increasingly being provided by companies who concentrated on the technical aspects, but did not include pedagogical theory.

This fragmentation has been increasing not diminishing.

However, partnership between education, industry and researchers can be fruitful when research and development for the company is an element in the mix. Rose Luckin's Golden Triangle of Evidence-Based Produce Design indicates the basis for this approach (Luckin, 2016 Figure 1).

Luckin indicates that the production of effective innovations in the design and use of educational technology will rely upon these key relationships between edtech developers and service providers and teachers and researchers being

fostered and strengthened. Developers need to be aware of existing evidence and able to use sound research methods to evaluate their products, researchers need to work with developers to help them acquire the knowledge and skills, and educators must be part of the process through their input to the design and evaluation of the technologies being developed.

The three partners were involved in the practice based research project were the MirandaNet Fellowship, Gaia Technologies and leaders and teachers from a school in a deprived area on the North East coast of England.

The MirandaNet Fellowship is a professional online organisation of more than one thousand members in eighty countries who are specialists in innovation for education futures. Links with Naace have always been strong. Some professionals are members of both organisations and they have been partners in projects funded by the Teacher Training Agency and the European Union. Gaia Technology is also a Naace sponsor. Christina Preston, who has won a Naace Lifetime Achievement Award, established MirandaNet in 1992 as itself an innovative model of continuing professional development (CPD) in education technologies: the first community of practice with a significant online component.

In this professional learning paradigm all the participants who are given equal status are actively engaged in generating knowledge and knowledge exchange together. This collegiate engagement generally works better amongst educators than amongst commercial competitors who have more reason to preserve secrecy (Lave and Wenger 1991; 1999; Wenger 1998; Wenger, MacDermott et al. 2002). But in the partnership described here all the participants are motivated to work together including industry in order to reap the benefits of collaboration.

Naace members have been advisers on the iCatalyst programme – MirandaNet's research and development process, designed to work through partnership with professionals and companies who are committed to learning. Associate companies work on developing practice based research projects that are appropriately designed and executed and the results are valid and reliable. In addition teachers and associates gain knowledge and experience through the iCatalyst programme that they can transfer to other learning contexts. In addition the companies are providing teachers and leaders with free professional development in austere conditions were schools have limited funding for reflection and learning.

The MirandaNet project partnership with companies is intended to bridge this gap and develop examples of CPD that works well, whilst identifying barriers that can stop effective CPD from working well.

In these circumstances the input from companies can raise the standards of CPD in digital technologies. This improvement happens because working with all key

stakeholders, the teachers and leaders identify what they want to gain from their investment in digital technologies in terms of evidence of learning. Crucial to success is the methodology of collecting of evidence of learning in the classroom and the ability to measure the impact of implementation.

Gaia Technologies, a learning organisation that is committed to systemic change in teaching and learning through the effective embedding of digital technologies in practice and policy. Gaia provide the digital services throughout the school as well as Gaia Innovate – a managed CPD programme focused on education and ICT, which includes training and project-based professional learning. This approach is intended to address the situations that frequently arise when new technologies are bought by a school, but their full value is not realised. Bernard Dady, Head of Education Innovation had completed a Masters in practice-based research on which he had based this Gaia programme. As a result there was no problem in fusing the iCatalyst and Gaia Innovate approaches to design a project for three schools where Gaia were providing services.

Bernard had quickly realised through his work that providing good supporting services will not ensure that digital tools are well used in teaching and learning. He was well acquainted with the variety of conditions that give rise to a lack of enthusiasm to use digital technologies in schools that have been highlighted in research studies. These key factors can be summarised under two categories:

Technical issues

- poor technical support;
- failing equipment;
- out-of-date equipment;
- absence of technical training for staff and pupils.
- insufficient communication between network managers and senior staff.

Leadership challenges

- lack of leadership from senior staff;
- inadequate planning of implementation by senior staff;
- lack of appropriate professional development;
- not enough recognition of the thinking and practice time teachers require to embed digital technologies seamlessly into practice and policy.

(Preston 2004: Pachler, Preston, Cuthell, Allen and Pinheiro Torres 2011). The grounded experience and thoughtfulness of Gaia representatives was a key factor in gaining the trust of the teachers.

The case study



This secondary academy in a new building on the North East coast had inherited the Gaia Managed Service from the predecessor school and benefited from significant capital investment in ICT. The driver for the adoption of an eighteen month Gaia Innovate CPD programme was to see if between them the company and the school leaders could drive better use of the technology through a project-based CPD programme. They were also addressing a specific problem because they were struggling to staff the new Computing curriculum and with the diminishing popularity of the subject, especially amongst girls. The key question was to establish whether introducing Digital Media studies across drama, music might be a viable alternative.

The practice-based research element developed with MirandaNet Fellows support was designed to gain insight into both the impact of the CPD programme and to understand the barriers that might cause elements of the programme to fail.

Collectively the Academy, Gaia and participants posed questions that they wanted to answer through the practice-based research process:

- How should we motivate teachers to be co-researchers?
- How can we increase the use of technology as tool for teaching and learning?
- What strategies can be used to diversify pedagogy?
- What are effective methods of addressing standards particularly in literacy and ICT skills?

The lead co-researcher, who like Bernard also had a Masters in Education, was very clear about the value of practice based research.

“An important aspect of this approach is to allow the staff to experiment with these opportunities afforded by the technology without the fear of being judged.

Based on Guskey’s levels of CPD evaluation (2002), the team ensured that the data collection tools invited the participants to reflect on where they had been at the start,

where they were at the end and where they were going next. The teachers and senior leaders were interviewed about implementation programme and the vision from the perspective of the senior managers, the ICT coordinator, key staff, the action researcher and the pupils in order to write a report on the project for internal use that identified the key issues from the Guskey perspective. The participants were also encouraged to report on their related projects. Focus groups were also set up to elicit the student response. The leader commented:

“The freedom to fail and to re-evaluate practice is vital to sustained change - when the three years support is over the teachers themselves and the pupils must then take ownership of the program and drive it forward. Also demonstrating to parents that the Academy is providing students with a passport for the future in an ever changing and developing world, and sustaining the pupils numbers at KS4: allowing the pupils to lead the curriculum”.

The project leaders overriding question for staff was:

“Students live in a technology rich world and often learn despite the staff ignorance in some areas: Are we pushing them or are they pulling us. Can we use their knowledge?”

A digital media production



When the project started the school was suffering competition from a new Academy built just 300 yards down the road that was boasting an ex-Microsoft employee as the Computer teacher. This challenge was added to the struggle to appoint trained staff to Computing at all and the drop in the numbers of pupils wanting to do Computing, especially amongst the girls. In this context this project was designed to test the possibility of introducing a Digital Media curriculum instead the next year across drama, art and music. The subject was the pupils’ own interpretation of the musical, Blood Brothers. The leader explained:

“Normally, in drama, the students would be asked to create a series of ‘what if?’ scenes, script and perform these as part of the course. We decided that in this case they would record those performances using green screen techniques. The drama students would then be able to commission digital backgrounds to enhance their scenes and the music

students would supply incidental music. In art students would focus on graphic design to be use in marketing a DVD product”.

The first stage of the project was analysis of the curriculum requirements and detailed planning of the project by Bernard Dady, Gaia, and the teacher team.

The second stage was the training of the teachers in basic skills by a Gaia consultant who provided training on:

- On the use of apps and software;
- Remote support during development stages;
- In class support for asset production.

The third stage was support for editing, production and presentation including a suspended timetable working day in February, which was filmed by Gaia, with subsequent supply of a promotional video. The video products were showcased at the presentation in March and over the summer Gaia collated the students’ videos ready for transfer to DVD .

The findings

This leader summarised the lessons that had been learnt in the first year that relate to Guskey’s first level about where the school was starting their journey and what needed to be changed in order that digital technologies were used better in the school:

- In order to ensure holistic thinking and create a clear vision throughout the school, CPD is needed for the whole team of leaders and the whole staff including the Senior Leadership Team (SLT);
- A gap analysis development to inform the second year CPD programme should be introduced;
- The IT department has been a bolt-on rather than being mapped across the whole school curriculum and needs to be more integrated.

Despite the fact that the leaders of the project acknowledged that they would have to adapt their strategies for the next year, it was clear that the pupils had been very engaged with the experiment. In their interviews they expressed that they felt:

- Fully engaged;
- Raised confidence;
- Developed resilience;
- Able to describe how they do their ‘best’ learning;
- Confident to choose and use different resources and strategies to develop their learning;
- Confident in helping others learn;
- More independent;
- Wanted to come to be in lessons in school and learning;
- Had higher aspirations.

The leaders of the project were invited to share their results with other teachers who were MirandaNet Research Fellows at a workshop sponsored by Gaia at the Institute for Education Futures, De Montfort University, Leicester which was designed as another CPD event.

Conclusions

The result of this practice based research project was that in the following year enough pupils elected to do Digital Media as an option to fill three classes. This indicates that this strategy may be a way for other schools to deal with the challenges of the new Computing curriculum. But by entering this research partnership with their service provider and the MirandaNet researchers the leaders have also built up practice based strategies for making whole school decisions that can be transferred to any area where practice based research can increase the opportunities for the professional to reflect and learn in advance of making significant policy and practice decisions.



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Visuality in Computing

A short essay on the visual elements of computing
Theo Kuechel, Senior MirandaNet Fellow

Summary

Visual literacy enables us to make best use of the powerful visual tools at our disposal. This is especially true for computing, which underpins almost every aspect of our lives. Computing's processes and skills empower us to create sophisticated visual resources, artefacts and digital assets. This article looks at the history of visual communication and discusses its impact on learning, technology and educational computing. It recommends computing teachers should develop an awareness of the visual elements within computing, and how they benefit and enhance the computing curriculum.

Introduction

Visual Literacy is the ability to read and interpret the visual codes and artefacts. Such artefacts include the signs, diagrams, maps, codes, images, films, models and visualisations in our lives. Visual literacy allows us to communicate effectively using visual media.

Visual culture is an integral part of the history of mankind. Our use of images has shaped our technology and also defined how we use technology.

"We shape our tools and thereafter our tools shape us" (often attributed to McLuhan[1])

Many people still think of computing as text and numeric data, but there is a strong visual paradigm embedded in computing. This covers two areas; (1) programming, coding, user interfaces, and tools. (2) visual applications that involve creating editing, storing, and retrieving visual data. Images, video, 3D models, maps and diagrams are all facilitated by computer processing.

How did we get here?

We can trace our ability to communicate using graphic devices back to the the paintings in the Upper-Palaeolithic. The caves of Altamira and Chauvet reveal, between 4,500 - 10,000 years ago, our ancestors; far from being savages, were capable of cognition, creating visual representations that record and communicate. Donald Clark[2], posits these may have been a form of teaching aids...

"What we have here is the first use of sophisticated simulators for learning. They match the criteria we expect in modern simulators. Cave paintings are therefore remarkable teaching and learning aids."

According to Clark's theory these codes and symbols would most likely be re-used and shared to impart and share knowledge of their world.



Oral narrative is temporary and subject to change and misinterpretation. Symbols, and iconography, offer a consistency which does not need prior knowledge of a given language. Until medieval times, iconography was essential in Western and Eastern religion for communicating its message, to an illiterate population.

It is also important to recognise writing did not appear out of a vacuum, but evolved through various elaborate stages. Later, pictograms, cuneiform, and hieroglyphics evolved into the writing we are familiar with.

Whilst text provides more complex, precise, and nuanced information than graphic symbols, it is always dependent on an innate knowledge of a specific language. Iconography is still present in the computer and digital interfaces of today. They provide visual control and feedback of functions. A good example are mobile apps which include no, or minimal, text.

Gutenberg and beyond

The invention and development of the printing press by Gutenberg was the catalyst for major change. It enabled the fast and widespread transmission of news, information, knowledge. Information could be copied many times and distributed widely.

The original Gutenberg Bibles were text only, with hand drawn illuminations. By the mid 15th century illustrations in the form of woodblock engravings were added to many printed works and by the end of the century illustrations in text became common in maps and scientific journals.

This sharing of knowledge encouraged the spread of the Renaissance. It also facilitated rising literacy levels in Northern Europe. It seems unlikely the internet could have happened without Gutenberg's Press.

Educational texts



For learning, an important milestone was Comenius's *Orbis Pictus*, first published 1658. It was the first book produced specifically for school-children. Although its primary purpose was to help students learn Latin, and, subsequently, other languages, it offered much more. *Orbis Pictus* is illustrated with 150 woodcuts, (or copper engravings in later editions). The book condenses the known world into pictures. Each one a stepping stone on the path to further knowledge. This is good example of early constructivist learning. Luan Hanratty explains further in his blog [TEFLideas](#)[3];

“There are no rule explanations. The learner is left to his or her own intuitions on the basis of connections between text, numbers and images to predict the meaning of the Latin translation. Thus the text embodies a natural, direct approach which stretches learners implicitly.”

The book's approach is didactic, but there is plenty of scope for individual interpretation. *Orbis Pictus* is a whole curriculum in a book. Alongside academic knowledge, it covers the essential life skills. Slaughtering, brewing, gardening, and animal husbandry are all promoted. The book encourages a sense of environmental awareness. Its method of numbering elements in an image is the precursor of the computer hot-spot

The age of 'computers'

From the mid eighties and through the nineties. Computers could easily handle, store, and display multimedia content; text, images, audio and video. Over 300 years later, educational resources for learning using computers, echoed Comenius's work.

A market for digital educational content soon established itself. Educational publishers replicated print based encyclopaedias and reference books, augmenting them with multimedia content and hyperlinks. Such educational resources were published as CD_ROMs and later DVDs.

They often included interactive learning activities. Although flagged as a future of a digital curriculum, the life cycle of these resources was short-lived. Microsoft Encarta is the best known example. Within 15 years its original price had dropped from \$400 to \$99, and it was not long before (parts) became free online. In 2009 both online and physical editions were discontinued, soon to be forgotten.....

From early-mid 2000's onwards, broadband and data storage technologies became much more powerful. Content moved from local physical storage media to online servers in the cloud. Yet it was still very much one way, top down, traffic until late 2004. It was then that Web 2.0 changed how we could interact with, (educational), content forever. Dynamic and unlimited content and knowledge became available at the click of a mouse.

Educational 'Computing'

Another significant milestone in educational computing was LOGO. Introducing visual elements into computing, Seymour Papert, Wally Feurzeig and Cynthia Solomon created LOGO; a programming language designed primarily for children. Logo computer instructions outputs are displayed visually.

Logo use of an on-screen turtle to display the instructions given to the programme. It lets children, and adults see their effect in real time. They can adjust their program designs, and correcting errors through this visual feedback. Logo can also be used to drive floor robots. The development of Logo made computational thinking visible. It allowed children to enter the world of programming much earlier than they might have done before. Once again a good example of constructivist learning.

Scratch



More recently Scratch the free visual programming language developed by the MIT (Massachusetts Institute of Technology) is said to have been descended from of Logo and builds on the constructivism of Logo. Like LOGO

Scratch is not restricted to on screen outputs and can include animations and audio

A key difference between Logo and Scratch is that children no longer need to remember individual commands, all Scratch's commands are available as visual blocks in an on-screen library which allows them to intuitively combine individual blocks of code to create an event driven program.

Scratch also introduces children to the concept of the 'remix' where they can post and share programs and projects online for others to reuse and adapt. Another inherent aspect of constructivist learning.

Taking it Further

To consolidate computing and computational thinking in the curriculum, visual tools can be invaluable. Flowcharts are essential for visualising and designing algorithms. Simple everyday tasks can be broken down into visual sequences. One can sketch them on the back of an envelope, or use any of the ubiquitous drawing software around. Similarly, there are also many free and premium mind mapping/ concept mapping tools available.

To encourage computing in schools, organisations including CAS (Computing at School)[4] or Naace[5] offer support and resources for teachers. Students and teachers may also access many free online MOOCs and courses. For example; Hour of Code[6] and Pixar in A Box - Computer Animation[7], from Khan Academy.

Making Images

Computing has transformed the way we create, store, edit, and handle images. The visible outputs are the some of the most obvious examples of the power of visual computing. Nowadays people of all ages participate in digital image making on a global scale.

"For the first time, pretty much everyone on earth is going to have a camera. Over 5bn people will have a mobile phone: almost all will be smartphones and almost all will have cameras. Far more people will be taking far more photos than ever before — even today maybe 50–100 times more photos are taken each year than were taken on film." Benedict Evan[8]

Amongst the billions of photographic images online, there is a subcategory of images generated by smartphone apps whose primary purpose is not the aesthetics of the image itself. These deal with sharing and interpreting visual data. Examples include QR codes, scanning, screen-caps, slide capture and infographics.

People remix, share and adapt their images, using image processing algorithms, such as the now commonplace Instagram one-touch filters. Some other filters are highly sophisticated. For example some automatically colour in black and white images using deep learning.

Searching for images is no longer dependent on text metadata. Image search tools such as Google Image Search, or TinEye show all instances of an image on the web. These becoming commonplace and increasingly used by a professional agencies and researchers.

Computer Vision



Computing capability has developed exponentially in the past few years and is becoming autonomous. It is also more widespread and accessible. Smartphone cameras can now photograph text and translate it into other languages. The latest example Google Lens offers an intelligent knowledge and search function.

Artificial intelligence, (AI) and deep learning read visual cues, identifying individual objects within images and video. They work by showing a computer an image and training it to recognise it. The computer subsequently learns from millions of other images, building up a knowledge base. With each new image its ability to accurately interpret visual content increases. These algorithms can be applied to any type visual data.

Such developments are facilitating some of the greatest technological changes in our history. Face recognition, automatic translation of text in images, robots, and driverless cars have been made possible.

Conclusion

It's essential curricula for computing, take account of the history of, and current developments in computing. It is vital that digital and visual literacy are referenced and used as appropriate in a computing curriculum.

A key question is how we can help teacher educators and trainers to understand this area and introduce visuality into their programmes? If we can it will help to make computing more interesting to learners in general.

Notes

- 1] <https://mcluhangalaxy.wordpress.com/2013/04/01/we-shape-our-tools-and-thereafter-our-tools-shape-us/>
- [2] <http://donaldclarkplanb.blogspot.co.uk/2012/09/caves-paintings-savants-not-savages.html>
- [3] http://www.teflideas.com/008_Learning_from_Comenius.html
- [4] <https://www.computingatschool.org.uk/>
- [5] <https://www.naace.co.uk/>
- [6] <https://www.khanacademy.org/hourofcode>
- [7] <https://www.khanacademy.org/partner-content/pixar>
- [8] <http://ben-evans.com/benedictevans/2016/8/15/imaging-snapchat-and-mobile>

EXPERIENCES OF THE COMPUTING CURRICULUM IN A UK PRIMARY SCHOOL

Dalian Adofo BA (Hons), PGCE, MA

INTRODUCTION:

The focus of this study was to explore how teachers and pupils had adapted and responded to the implementation of these changes to their curriculum. Conducting it at primary school level was particularly important as it had been one of the main areas of contention in the consultation process as some felt such changes would be especially daunting and largely inappropriate.

The study was undertaken against a backdrop of national curricula changes, three years after the implementation of Computing as a curricula subject. The study was initiated to explore the impact of these changes on teaching and learning in a primary school.

Many Naace members will know the history of the introduction of the new Computing curriculum but I will describe here, from my perspective, as the background to my research project. This new Computing curriculum was introduced into schools by the UK government in 2014 to replace Information & Communications Technology (ICT), following a public consultation in 2013 by the then secretary of state for Education, the Rt Hon Michael Gove. The consultation closed on 16 April 2013.

Computing replaced ICT with under section 84 and 85 of the Education Act 2002 by the government as "ICT as a subject name carries strong negative connotations of a dated and unchallenging curriculum that does not serve the needs and ambitions of pupils. Changing the subject name of ICT to computing will not only improve the status of the subject but also more accurately reflect the breadth of content included in the new draft programmes of study."²

The new programmes of study for the novel curriculum were devised in association with industry experts from the Royal Academy of Engineering and the British Computer Society and the subject content informed by the classification of content in the Royal Society's report on computing in schools called 'Shut Down or Restart'.

Some of the key findings arising out of that report identified that delivery of Computing education at the time was "unsatisfactory" and "uninspiring" with the content "nothing beyond basic digital literacy skills such as how to use a word-processor or a database."⁵ The report put this down to a range of factors including an ICT curriculum that was too open to interpretation and as such could be taught by non-subject specialists, a shortage of teachers with adequate skills to teach beyond "basic digital literacy", lack

of continuing professional development for teachers of the subject and institutionalised structures and prevailing attitudes that inhibits "effective teaching of Computing."⁵

The drive for change was therefore to re-brand the subject as a 'rigorous academic discipline of great importance to the future careers of many pupils' such that its status would be raised and recognised by government and senior management in schools. This would be in contrast to the one-stop-shop for all that ICT had gradually devolved into with hardly any recognition of its importance in the digital societies of today.

For the children, "Some respondents raised the question of how it would be possible to teach young children with very basic levels of literacy and numeracy how to programme." For the teachers, "Some respondents felt that the proposed curriculum may be daunting for primary teachers who are not specialists in computing and would not be equipped to teach it."²

BACKGROUND CONTEXT TO THE STUDY:

This research project was conducted as my main project for a leadership course I was enrolled on with the National Union of Teachers that run from November 2016 until July 2017. The aim was to explore the experiences of primary school teachers and their students with the new Computing curriculum as well as the impact it was having on teaching and learning, to identify from the research findings changes for improvement that could be implemented or issues that required addressing. The school used to conduct the research is a non-denominational, mixed North London primary school, one of the largest in the United Kingdom.

RESEARCH METHODS & SAMPLING:

A questionnaire on Survey Monkey was used to capture the teachers' responses to the transitioning to the new curriculum and a focus group meeting was used to informally question and elicit students' responses with one of the teachers present.

The students were in Year 5 and had experienced the changeover in curricular requirements from ICT to Computing that occurred whilst they were in Year 3. There were a total of 6 pupils; 4 boys and 2 girls.

In total, 6 teachers responded to the survey and of these 2 were teachers with responsibilities and 1 the subject leader for Computing. One additional teacher was present during the focus group meeting who was also informally questioned to add further context to the pupil's responses.

FINDINGS & ANALYSIS:

Teachers:

All the teachers who responded indicated that they had not received any external training nor taken up opportunities to develop subject knowledge via organisations or forums such

as 'Computing At School's portal or hubs indifferent parts of London.

Il training had been provided in-house to staff and as a result the newly introduced software onto the curricula consisted of Scratch, Movie Maker, Snap, Kodu, 2 Paint and programmable toys (Bee-bots). The programmable toys were for the Mathematics department and the Computing department only used them in the early years to give pupils a basic feel for logic in programming, but access was limited. They were mainly used to assist in counting tasks to get children to appreciate Mathematical operations like Addition, Subtraction and Multiplication.

The curricula has been reformulated such that programming and logic only started in the latter years from year 4 (KS2) upwards as teachers had identified that it was the stage at which pupils could most adequately deal with the topics and their cognitive demands.

In the earlier years (KS1), they introduced the pupils to basic digital literacy applications, mainly the Microsoft Suite of programs as well as functions such as folder management.

Their concerns in this regard were not far removed from those identified during the Government's consultation about the reality of children deal with programming concepts and computational thinking.



All teachers had identified, and responded as such, that the gaps in learner's knowledge identified that was making it difficult for pupils to access the computing curriculum were mainly from not being familiar with the usage of computers. They could not perform basic skills such as saving a document in the appropriate place, knowing how or where to retrieve it, saving duplicates and so on.

"Spending time on basic computer skills, although this then makes it difficult to cover the higher-level aspects of the curriculum due to lack of time."

" I expected them to be difficult, but perhaps not to this extent. For students without basic typing and touch pad skills, the new curriculum expects a lot from them."

"The basic such as highlighting, copy and paste they do not know."

"They have been excited by the prospect, but basic skills, for Microsoft Word, Powerpoint and Excel have been neglected."

"Developing the pupils basic Computing skills in KS1 when using Microsoft programs such as Word and Powerpoint."

Their comments also reflected a socio-economic dynamic to the various pupils' progress in their learning and this was confirmed during the focus groups for the pupils. Those with access to computers and relevant software at home demonstrated a better understanding of tasks and could articulate it much more clearly than their peers and more will be covered on this in the relevant section of this article.

On the question of recruiting specialists into the profession, the teachers felt this to be necessary as "The curriculum takes on a whole new area of expertise which many teachers are not familiar with, therefore a specialist could help train teachers." Again a direct inference to issues that had already been highlighted in the consultation stages but seemingly had not been addressed such that they were still present 3 years later, after the implementation of the new curriculum.

Only 1 out of the 6 teachers stated that the new curriculum seemed to be enjoyed more by the boys than the girls, without providing definite reasons why, suggesting that there was not much disparity in gender take up or interest in the subject in the school.

The teachers had been very responsive to the new curricular requirements in terms of ensuring it to be a smooth fit with the students and adapting to the new challenges posed, as already highlighted with the introduction of new programs and software.

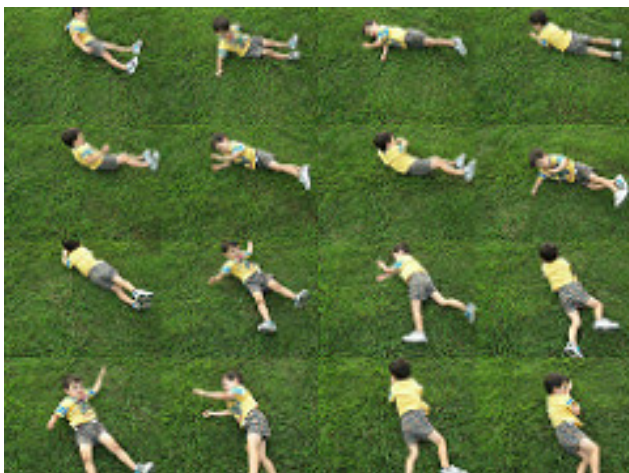
In addition considerations had been made for meeting other challenges such as the lack of time to cover all curriculum requirements and improve basic skills with the introduction of iPads and laptops to improve finger/touch and typing efficacy and get around no access to computers at any given time. Similarly, incorporating basic skills through Microsoft Office and the programmable toys in the early years to give their pupils an appropriate entry point into Computing.

Pupils:

The pupils were in agreement that it was "fun" and "easy" in Year 3, when Scratch was introduced, as all the things they used it for then were simpler- getting a character to move and rotate, simple computations.

In Year 4 and 5 it had become more “challenging”, their most recent project was in using it to create “Tessellations” for which they had to calculate relevant angles and lengths to fit all pieces together to create shapes.

They were all clear on the role and use of Mathematics to attain these objectives using the program and this was



made much clearer because the project had started off on paper, where they had to first draw the shapes by hand and rulers before recreating them using the software.

The correlations with Mathematics were further reinforced across other projects as well where they had to create structures, scenes and landscapes. For the spaces they had to calculate the “surface area” so they could determine how many steps their “sprites” (characters) would need to walk from one point to another, so the relevance of Mathematics was intrinsically built into various stages of the project and it was perfectly clear to all the pupils too as they could articulate it clearly in their descriptions of the work they did.

What was most impressive was their familiarity with and use of appropriate Computer and Mathematical terminology as referenced above, even to the surprise of their Year 5 teacher present during the interviews.

One male pupil who stated he had access to Scratch on his home computer, had managed to build his own mini-game with interactive elements to the user such as a function to tally up points scored, all on his own from what he learnt in class.

In the same vein, after using a 3-d builder program “Spec” in school, he had managed to create an entire scene of a train track connecting 2 different stations and he had to calculate the size of the tracks in relation to those of the trains so they could fit and run on them. His aptitude for Computing seemed much higher than his peers with the only explanation pointing to the fact that he also actively engaged with the various software at home and his higher level skills were due to extra time spent individually learning

the software. This correlated directly with the comments by the teachers about a majority of their pupils lacking basic computer skills because they “had no access to it at home” . This particular boy reflected the very opposite of this trend, due to his access at home he had developed his ability much more than his peers and was subsequently using it for more challenging tasks.

The pupils had used “Spec” to build buildings and urban scenes as a class activity with the added task of budgeting the cost of materials and the entire cost of the construction. When asked what real life skills they were learning from this project, they suggested “Engineering” and what they enjoyed most about the project was that it was just like creating virtual spaces in Minecraft.

What this further highlighted was the impact external activities pupil participated in outside of school could have on their engagement and learning. As Minecraft had similar aspects to “Spec”, it seemed to be a contributing factor to their enjoyment and engagement in using it at school.

A similar trend was noted in their level of enjoyment with Computing projects that had discernible real life relevance. So in Year 4 when they used Scratch in a ‘weather casting’ project, it felt to them that they were being “like the weather man on TV”. Similarly on a music production project in the same year, they could barely hide their excitement recounting the process involved in making their songs, with one boy excitedly remarking, “I felt like a DJ”.

What it made explicit was the fact that they clearly enjoyed the projects they discern as a ‘real-life, concrete endeavour’, even better if it was one they were familiar with, rather than abstract projects that were outside their zone of comprehension, experience or knowledge of.

What the study also made clear was that there exists great opportunities for the new Computing curriculum to foster much interdisciplinary learning, in such a way that different subjects can compliment and reinforce each other.

So in the instance of Mathematics, there could be a convergence of some of the lessons rather than separate ones. Schemes of work could merge subjects together to deliver them in a unified approach e.g. Tessellations could be incorporated into a Maths and Art lesson even, to further afford a deeper understanding of angles and transformations and provide the opportunity for pupils to identify the synergy between Mathematical rules and the production of Artistic pieces, using Computing to facilitate this.

LIMITATIONS:

The project started halfway through the Spring term at a period when many teachers were preparing their cohorts for the SATs exams so there was not enough time to meet with all respondents who participated in the survey to get clarifications and elaborations of some of their responses. This would have been useful to facilitate a more in-depth exploration of the reasons for the answers to particular questions, such as why one teacher felt it was only boys who were showing a keen interest in Computing as opposed to the girls.

The opportunity to have examples of the pupil's work on display during the focus group interviews would have been useful for further exploration of how deeply ingrained their understanding of computing was and the degree of computational thinking employed.

RECOMMENDATIONS:

A study stretching over an academic year will be most useful in identifying how different projects may encourage computational thinking as well as those that specifically affords pupils' learning of other subjects. This would allow educationists the opportunity to devise future projects that are more holistic in their approach and can contribute to making computing a more engaging and interesting subject to pupils.

Comparative studies that research the virtual external activities of pupils and the impact it can have on their learning. This will be useful data to inform for the commercial and educational sectors.

CONCLUSION:

It is fair to say the Computing curriculum is relatively new and still needs work in identifying best fit within the National Curriculum, to make it fulfil the grand vision the UK government has for its impact on future generations.

Teachers have embraced it and making the best with what they have or have been provided with. An interesting observation however was that none of the teachers in the school referenced or even seemed aware of the Computing At School initiative and how useful it has been to others in providing free training to build skills and knowledge base. It would have been an additional resource the school could have used in capacity building and suggests the government needs to step up its advertising and promotion to schools across the UK to encourage further uptake.

The new curriculum presents vast opportunities for interdisciplinary learning, especially with Mathematics. Based on how projects are devised, pupils can clearly identify what other subjects are being facilitated in their learning, therefore more research is required to understand what aspects of a learning project allows the child to make these connections.

As most primary schools mainly employ a single teacher per year group, there is ample opportunity for a different approach to how subjects could be learnt. Rather than separate lessons dealing with specific subjects all the time, an opportunity exists to integrate some subjects topics with Computing to make these interconnections even clearer.



Due to the ubiquity of electronic devices and equipment, it also affords a path to bridging bricks and mortar teaching with social learning and for this to be achieved, a synergy must be achieved between commercial concerns and educational needs.

As 'new' as Computing may be on the lower spectrum of the curriculum, with great care and strategic delivery it could transform the learning culture of the UK in many ways as yet unrealised. If this opportunity is not acted on with urgency, then it runs the risk of becoming the neglected dinosaur that its predecessor ICT became.

The creative spark and grind of technology in education

Jon Audain

Senior Lecturer in Primary ICT and Music | Department for Teacher Development | Faculty of Education, Health and Social Care | University of Winchester | Winchester SO22 4NR



The spark and the grind

Just look at this mess! EdTech, Information and Communications Technology (ICT), Computing, Information Technology (IT), Computer Science (CS), Digital Literacy. It is the odd sock syndrome again, where the pairs should line up together in the drawer, but this simplicity has often been lost. Naace members will be aware of all the conflicting definitions. I have to support our university students as they try to pick their way through the minefield.

Technology when used acutely and accurately in the classroom can have a positive impact on children's learning. But the use of ICT has grown in schools at an incredible rate, which has led to teachers having to acquire different ICT skills and widen their awareness of the different classroom technologies out there. Often the training lags behind.

With the rise of the internet, interactive whiteboards, computers and mobile technology so small the connected world can fit in your pocket, it is no surprise teachers are struck by the rate of change of technology in schools. Along with its ability to change the way we think, interpret and express ourselves, its ability to impact on learning is also staggering. While you are reading this article, cast your mind back to the technology that was available to you in your childhood. Perhaps the video recorder, the Walkman with tapes, or the vinyl record which you bought from the shop before eagerly walking home and lifting the delicate arm and needle of the record player to hear the music.

Technology evokes strong memories for many people who use it. It is a BIG deal. It can be compared to the ideals of

the fashion industry, the glitz, glamour and anticipation of what is going to be the next big thing to get our hands on. These things will enter our homes, the family environment and will be used by our children. Ultimately, they will also change the way we educate ourselves and learn.

Yet in some areas of education, we are forgetting the power technology provides. When teachers employ their use of digital technologies to different activities, these can generate these powerful memories for the pupils we teach. Erik Wahl's text 'The Spark and the Grind: Ignite the power of discipline creativities' raises some interesting questions between the relationships between technology; the teacher, and then learner. Wahl (2017) proposes the point that creativity in any activity consist of two elements: the 'spark' and the 'grind'.

Both should coexist side by side. The 'grind', referring to learning the routine and craft of the activity you are involved in; the mandatory process of just fulfilling the mundane requirements of the tasks provided as part of the course of a normal working pattern. Where as the 'spark' signifies the generation of newness – new ideas, different activities against the norm and in essence, the multiple generation of these sparks in order to trigger a creativity out of the daily grind. Not all sparks catch light, but all it takes is one to make a difference to the teaching and therefore in learning more about the subject.

The student perspective

In the face of the variety of digital technologies, I both struggle and am excited by the rate of change Computing can deliver. Throughout my teaching career, I acclimatised to the speed of new initiatives and was left to discover how these could change the culture of my classroom.

I was talking to some undergraduate students once about what it is like to grow up using Snapchat/Facebook/Instagram and be constantly in the public eye of everyone. I asked them why they made the choice to be on there. Here are some of their answers:

- It's a photographic record of fun times and events. Just as people used to print off their photos and put them in an album, this is our way of doing that;
- It's my main way of communicating with friends;
- My friends use it to help me get organised;
- We use it to collaborate and keep ourselves on-task.

I was once teaching a young person and we were working on performing a piece of music together. I asked her to listen to another performer playing the piece. I explained that it was on YouTube and why it was a great example to listen

to. She responded by explaining that she couldn't go on YouTube at home because her dad had blocked it, but it was OK because she would have a look on her phone!

My point is that technology is all around young people and there are a variety of different ways of accessing it. If we are not careful, considered and open about the way young people use technology then we begin to mistake our reservations and anxieties for safeguarding. The barrier the adult had placed in the way did not phase this girl at all. She is growing up with technology and it is forming part of her culture: it is her background. The young will always find a way around in secret if we do not engage in the process with them.

Somehow and somewhere along the line, the UK Computing curriculum became heavily weighted towards computer science and in the process of focusing on algorithms, debugging and coding we forgot the most fundamental point made within the National Curriculum (2014), that primary children should,

select, use and combine a variety of software (including internet services) on a range of digital devices to design and create a range of programs, systems and content that accomplish given goals, including collecting, analysing, evaluating and presenting data and information

They should have the sparks lit so they understand more about the grind but so they can also demonstrate innovation in their digital skills. It fosters the notion of a different technology-based background from the experience of our own and this is important as it helps shape children's ability to interact in a global space.

Early experiences matter. In April 2012, The National Trust launched a campaign entitled, '50 things to do before you're 11½'. The campaign sets out 50 challenges for children and families to complete together which enable children to have outdoor experiences creating exciting childhood memories. Bravo! If children were to complete these tasks, then they would indeed add many fond childhood memories and rightly so. Technology also adds to the background of a person. Look below at some of the technology introduced over the decades. How much of the technology below shaped your childhood experiences?

How ICT motivates children

Technology has always had an effect on its user. Whether it buzzes, flashes, emits a sound or illuminates, it inherently beckons its user to do something. It is important to remember that all technology has an ON/OFF switch and

throughout children's development they need adults to be their filter and help them to moderate their use.

Regardless of the time they spend on the computer, ICT has the potential to motivate children in a number of different ways:

- Trial, error and review – by far one of the best processes to come out of using technology, is the fact that computers allow us to change our work and minds in unlimited ways. What is interesting about this is that it changes the way we complete a task, read our work and continue try to improve it until it is finished;
- Reward with goals – computers can make a large task achievable. They can be programmed to reward progress at different stages and can keep a user achieving. This is particularly useful for mental maths and other activities which require repetitive stages and rewards. Imagine trying to combine the web, video and text tools available so that you can learn a new skill or demonstrate your knowledge. At the end of their learning they rewarded with the satisfaction of a piece of work;
- Problem solving – ICT can present problems in different ways to children. The combination of adding video, text and websites can open up new potential for presenting investigation work. For example, use your interactive whiteboard software to present a maths investigation. The children can then move objects around the screen. The ability to be able to use the 'undo' command in this situation makes it easier for children to explore different answers on a trial and error basis.

From a teaching point of view, using digital tools and drama can add an interesting twist to the beginning of a lesson or, at certain points, to progress the learning. For example, when teaching the children to write a newspaper report, use an introductory film clip you have created to introduce the topic. Put yourself in the role of a newspaper editor. Don't worry about it being polished, your children won't mind. I would always tell the children that it was my super clever brother, which always raised a chuckle! You could also make shorter 'helpful hint' clips to embed throughout the lesson to remind the children to include certain features or editor challenges to stretch your most able children.

- Creative freedom – children can use ICT to create anything they wish to communicate. Art tools, web tool and different platforms all allow children to use the medium of technology to express their ideas. Mobile technology is making the educational 'grind' of learning much easier for children to create, consume and capture their thoughts.

- The ability to redo, undo, resize and replace anything and everything on the page helps the user to tailor an idea until they are truly happy with the look as well as the content.

A challenge for you



Digital technologies can have a poor press from time to time as people take its uses to extremes. Anything digital, used in excess, can risk compressing other areas of life. Part of our nurturing adult role is to encourage children to grow up in a broad and balanced way while encouraging the interests of the individual. All of this is still possible with the introduction of technology. In fact, technology helps individuals to develop 'awe and wonder', and to try out concepts in a virtual world before committing to real-life situations, as well as capturing moments and preserving their memory.

Children will overtake the majority of adults with the speed in which they are able to work out and use technology.

However, we as adults have the experience to educate children in the responsible use of the technology and to set boundaries for how they use it. It does not have to be 'the Big Bad Wolf' if it is used as a tool to strengthen and enrich learning. We also need to be able to show children how technology is not just about digital developments, game playing and the internet, but that technology has enriched other areas of the world from travel to medicine. The introduction of new technologies such as mobile technology, augmented and virtual reality should offer any teacher great sparks of imagination against the implementation of how we are testing and assessing children at the moment.

Deepening the learning encourages children to question what they are seeing. Deepening the learning through the use of digital innovation widens children's view of the connected multimodal global world we now live in.

To that extent I am proposing a challenge to widen this perception. Earlier in this article, I referred to the National Trust's '50 Things to do before you're 11½'. The same

could be applied to digital and technological activities. What else would you also include?

'Digital and technological' things to do before you're 11 ½

Awe and wonder

- Experience a planetarium space display.
- Use a digital video recorder to record a family member or friend's event.
- Take a digital photograph of the most amazing sight in your eyes.
- Travel to a place you have not seen in virtual reality. Stand under the Eiffel Tower or Colosseum wonder at how they were created.
- Learn a skill using YouTube.
- Watch a 3D movie.
- Read/experience an interactive book.
- Interact with a talking robot.
- Go on a digital scavenger hunt.
- Use augmented reality to interact with information. Use Blippar to see a butterfly transform and move.
- Practical with adult help
- Change a light bulb.
- Cook a cake using a microwave.
- Learn how to re-wire a plug safely.
- Use the internet.
- Object related
- Play with a remote-controlled toy.
- Use a touch screen tablet.
- Use an interactive whiteboard.
- Experience using a green screen (this effect is used in the Superman films and you too can become just like Superman flying through the air).
- Software related
- Create your own computer game using basic programming.
- Create a short movie.
- Create a word cloud using Wordle.
- Use a different computer operating system.
- Create a piece of artwork using Tagxedo.
- Create an animated movie using Lego characters.
- Learn how to use social media responsibly within a learning context and for connecting with other learners.
- Do Tweet or email me your ideas to share with my students:

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Jon's latest books are:

- Jumpstart! Apps <https://www.routledge.com/products/9781138940161>

- The Ultimate to ICT for Primary Teachers - <http://www.bloomsbury.com/uk/the-ultimate-guide-to-using-ict-across-the-curriculum-9781441144003/>

He is also working on the knowledge exchange project: Mapping Educational Specialist knowHow (MESH) <http://www.meshguides.org>

@jonaudain

Jon.Audain@winchester.ac.uk

Online safety and digital literacy: how do they feature in schools?

Rob Ellis: Naace member and Fellow of MirandaNet

Summary

This article about the teaching of online safety and digital literacy has grown out of a shared concern amongst education technologies experts that the development and learning of issues related to online safety and aspects of digital literacy have stalled in UK schools. We have based our views on wide and valuable experience of educators who responded to our preliminary survey from two professional organisations, Naace and the MirandaNet Fellowship, as well some schools. The results indicate how many issues are still to be resolved and identifies areas for urgent research, and so we conclude, not with answers, with more research questions.

Why is digital literacy important?

It is some years since we woke up to the idea that schools should protecting children whilst they are in their care and educating them for when they are not. This article is born of a concern that the acquisition of the skills of digital literacy might not be as well understood as we would hope. If “the web is the dominant medium of society.”, we are right to be concerned. A key question is whether teachers are sufficiently engaged to see the solutions.

A post on the JISC website says, “We define digital literacies as the capabilities which fit someone for living, learning and working in a digital society.” (2015) The article goes on to define subsets, but the one of immediate interest refers to information literacy. The American Library Association (ALA) say, “Digital Literacy is the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills.” We might see this as an aspect of online safety in general which concerns itself with users’ safety and well-being, both physical and mental. We are well used to talking about online grooming and cyberbullying but this sort of literacy is also one that is a life skill. The ability to evaluate and use online information well, to put it simply, is one that enhances the accuracy of schoolwork, protects from things as diverse as dietary fads and radicalisation and, for adults, avoids the purchase of a non-existent timeshare.

Why are some educators oblivious to the dangers? Firstly, if there is a lack of engagement why might this be? Lack of engagement does not imply a lack of care, rather a lack of internalised understanding. An explanation might lie in the contexts we draw on to learn. Typically our behaviours are

acquired from the collective experience of society. In this instance online life is so recent a phenomenon that the collective experience does not really exist. Children, teachers and parents can often talk about risks and dangers but are still making sense of the web themselves so that the examples they use seem detached from their reality. Parental engagement is a good example. I spend plenty of time in classrooms and my supposition is that if you go into any classroom in the country and ask who has been told not to talk to strangers you will most likely get 100% responding positively. This is the result of the care parents take with their children in the physical world. It is the same sort of advice they were given by their parents and so on. But very few parents engage with a chance to hear about keeping their children safe online. School staff, like everyone else, come to the online world with no background.

In the same vein it is interesting to ask primary school children who they talk to online, and then take them back to their definitions of strangers – the realisation begins to dawn. Only recently a teacher expressed how well her pupils were able to articulate online risks, but how poor they were at taking the very precautions they described. Alternatively we might ask parents about the precautions they take when their children go out to play only to discover that they are nothing like as rigorous when it comes to knowing where their children are off to online and who they are there with.

‘Fake news’ is an element in the phenomenon



Despite this apparent lack of resonance with the wider world there are agencies such as the Child Exploitation and Online Protection (CEOP) of the National Crime Agency (NCA), South West Grid for Learning (SWGfL) and numerous children’s charities who have produced excellent resources for young people, parents and schools who have a tight grasp of the issues. Well worth a look is the Digital Classroom work of Dr Jane Reeves, Professor of Teaching,

Learning and Innovation in Child Protection at the University of Kent. Her designers had developed scenarios in applications like Facebook so that the pupils and students go through the simulated process of being groomed in order to see how it was done and analyse the processes in groups. This is a powerful tool to combat these cruel strategies. Some experts in this field also responded to a short survey by MirandaNet and their views add weight to this article.



Good practice suggests that online safety is best taught with a range of approaches with special assemblies and visitors supplementing a planned scheme of work. Currently, with National Curriculum requirements it is largely the preserve of the computing department or teacher who tend to be reliant on special events. Encouragingly there seems to be a shift from a focus on technologies to behaviours, helpful when the 'flavour of the month' app changes so frequently. Another shift is towards seeing online safety as more of a whole school issue and one with implications for other subjects. A common view is that it fits well into the Personal, Social, Health and Economics (PSHE) curriculum with important implications for emotions and appropriate behaviour. Another reason for this shift is that curriculum time for computing is being squeezed.

But these shifts in attitude are painfully slow and meanwhile some students are struggling with the realities of online engagement. One respondent to the survey cited the difficulty a young person on the autistic spectrum had with managing behaviour because it was online. This illustrates the kind of challenge that young people encounter: admitting to behaving differently online is not uncommon

Some experts recommend that allowing users safe access to the Internet is in a way analogous to introducing children to road safety. Advice needs to be age appropriate, but is vital in helping them learn about being in a virtual environment just as we do in training them about their physical environment. One way to do this is to web publish schoolwork or to encourage blogs which opens them up to an audience greater than just one teacher. Steve Gillian is a

MirandaNet Fellow at Thurlbear Primary School who has promoted the value of pupil blogging.

Steve's greatest concern is the impact of the press and social media, on parents' and pupils' views of the world, "The press often twists the truth and it is hard for the audience to know which voice on social media to believe and which journalist to trust. I fear most the constant diet of soundbites where the reasoning behind the idea is not clear, or not available at all. Parents and children soak up everything, good and bad, that is said about education in particular," says Steve, "The staff often have to convince parents that the school are taking decisions for the right reasons. Leading parents, children and staff through the forest of fake news and false information is a major responsibility that I feel keenly".

Steve's passion is blogging – an important tool in developing pupils' digital literacy and media awareness. He encourages the pupils to express their own passions using J2webby. He has found this tool from Just2easy, requires fewer clicks before the pupils get to the creative interface than comparative packages.

"My view is that when the pupils publish themselves they learn so much intuitively about how information arrives on the web and become more curious about who the author is. Blogging is also an excellent way to teach responsibility and safeguarding because the system is robust".

In this context Steve talks about 'fake news' as a current concern. The teaching of media literacy has been an issue ever since information began to appear online. A common response is that education, starting in the primary school, will solve this problem. However, this assertion is usually coupled with the observation that not much is actually happening in schools. One survey respondent stated that the Ofcom Media Use and Attitudes Survey (2016) highlighted the fact that students judged veracity not on content but production and presentation values. If the resources 'look' professional young people regard them as reliable. They do not focus on the source of the information. The superficiality of these judgements when they are not challenged is a matter of concern because by adulthood a young person needs to have transitioned from being protected to being supported and, finally, to independence. To do this, schools need to provide an environment where mistakes can be learnt from without damaging consequences. If it is the case that "...two in ten believe that if a search engine lists information it must be true" there is much to be done. Departments such as History, English,

Science and Geography, to name just four, could play a key role here.

If most schools have an online safety policy it is often the case that this policy does not translate well into practice due to complexity of the context or the lack of engagement of different parts of the school community in its construction. An online safety policy is a good starting point although to be successful it must be translated into wider good practice. An excellent report into the plusses and minuses of schools' online safety activities is produced by the South West Grid for Learning (SWGfL) based on schools using their 3600 resource highlights many of these issues.

But one respondent warned that too many such policies are on paper only. Warning students of the potential issues around 'friending' might not be helpful if schools don't let them near social media. Again, they need supported access and teaching about how to cope with real situations rather than just discussions and warnings. Jane Reeves' simulation on Facebook is a response to this need. Teachers need courage to tackle this simulation but the results indicate this is a very effective method of warning about online behaviours like grooming.

Copyright is another neglected issue and if touched upon at all is more likely to be with regard to plagiarism than intellectual property issues. It seems likely that not only are school students unaware of the existence and purpose of Creative Commons but the situation is further confused by a similar lack of knowledge on the part of content creators who would be happy for their content to be repurposed but do not know that they can label it - thus making anyone who is concerned by copyright unlikely to use it. In any case the downloading of copyright material through sites like Pirate Bay suggests that the issue is either widely misunderstood or simply ignored.

"The ability to re-edit copyright works in new and experimental ways is seen as an important learning and teaching exercise for creative skills." The document from which this is taken, *Exceptions to copyright: Education and Teaching*, is helpful but more definitive advice is needed. How many teachers who use copyright material all the time understand fair use?

Meanwhile SWGfL is currently working with the UK Council for Child Internet Safety (UKCCIS) on exactly these issues and are publishing a framework in September of age-related expectations from EYFS to Year 13 across eight strands with further work on a delivery mechanism and assessment outcomes to support educators in addressing those difficult areas that have been latent and diluted by poor online safety

messages that are old and do not resonate with children and young people.

There is a risk, however, that a perceived focus on computer science will further dilute these important messages that were probably not well embedded in the first place.

Conclusion

So the conclusion that we have drawn is that the topic of online safety is not registering with many teachers: others acknowledge the topic without any real internalisation. Issues such as information literacy are still very much in their infancy as is copyright in the Internet age. Work needs to be done to make all aspects of online safety a pervasive part of the background to everyday life. To return to a road safety analogy if motorised transport had developed in the same way as the Internet we would still have our modern cars, but in terms of safety would still have someone with a red flag walking in front of them.

I hope that readers do not recognise their own schools in this negative picture about schools' capacity to deal with online safety and digital literacy. But I have found in my work and in my first survey that those who are tackling these issues are probably in a minority.



Further research

My small-scale research indicates that more needs to be done in this area. The survey questions were?

- What do you see in schools as the current balance between e-safety as the preserve of Computing and taught as a more general life skill? In which curriculum area is it also taught?
- Are you seeing an increase, albeit slow, of the online publishing of students' work and blogging? Is this helping pupils to spot the dangers?
- Facebook's intention to help users spot fake news is a specific instance of digital literacy. How do we best help our students to progress over their school life from using only provided links to complete independence? Do you have any examples?

- Are school safeguarding policies paying sufficient regard to the continuing safety of students into their adult life? Do you have any evidence?
- How widespread is an understanding about copyright, reuse of online resources and things like attribution?

Based on the analysis of the responses to the questionnaire I suggest some deeper questions need to be asked about the current situation:

- Is online safety and digital literacy as well addressed as corresponding issues in the 'real world'?
- What can be done to embed online safety and digital literacy as part of life in all schools?
- What are the most successful models for effective teaching and learning with regard to staying safe online?
- How might students be safely allowed to interact with the risks of the online world without danger?
- What benefits are there in the online publishing of students' work and what do they need to understand to do this safely?
- What is the national picture with regard to students being able to search for information efficiently and what strategies do they have for recognising rogue websites?
- What needs to be done to ensure wider ownership and more unconscious use of safety policies?
- What are the main issues regarding copyright for schools
How widely recognised as important is copyright?

We hope that members of organisations like Naace and MirandaNet will share their evidence so that we can develop guidelines about how to proceed. It is a rocky road for teachers at the moment with no clear guidance. Sharing expertise in a professional organisation can help to lead us all in the right direction.

Who's afraid of the GDPR?

Allison Allen, Director, Outstream Consulting
Allison is a Governor and the Chair of Standards Committee with responsibility for monitoring SEND and Assessment and Outcomes at Heathfield & La Fontaine Academies which are part of the STEP Academy Trust. She is also the Naace pro bono Online Safety Lead, SRF e-Safeguarding and Curriculum Framework Review Groups Lead and Past Trustee.

Summary

General Data Protection Regulation (GDPR) will become law in the UK May 2018 following a two year period allowing organisations to prepare. Some schools are in panic while others are calmly preparing for the changes the new law will bring.

Schools have clear responsibilities as data controllers and processors under the Data Protection Act 1998, but there are significant changes to the processes and systems.

There are fearful tales of multi-million pound fines and yet many schools are unaware of the impact of the new law. This article takes a matter of fact look at the changes brought by the GDPR, school readiness, the implications of the new law and what the best schools are doing to ensure that data is safeguarded - how through pragmatic planning, schools can achieve compliance with the new legal concepts 'Privacy by Design' and 'Privacy by Default'.

Safeguarding and security

Safeguarding and promoting the welfare of children is defined by the UK government as: protecting children from maltreatment; preventing impairment of children's health or development; ensuring that children grow up in circumstances consistent with the provision of safe and effective care; and taking action to enable all children to have the best outcomes.

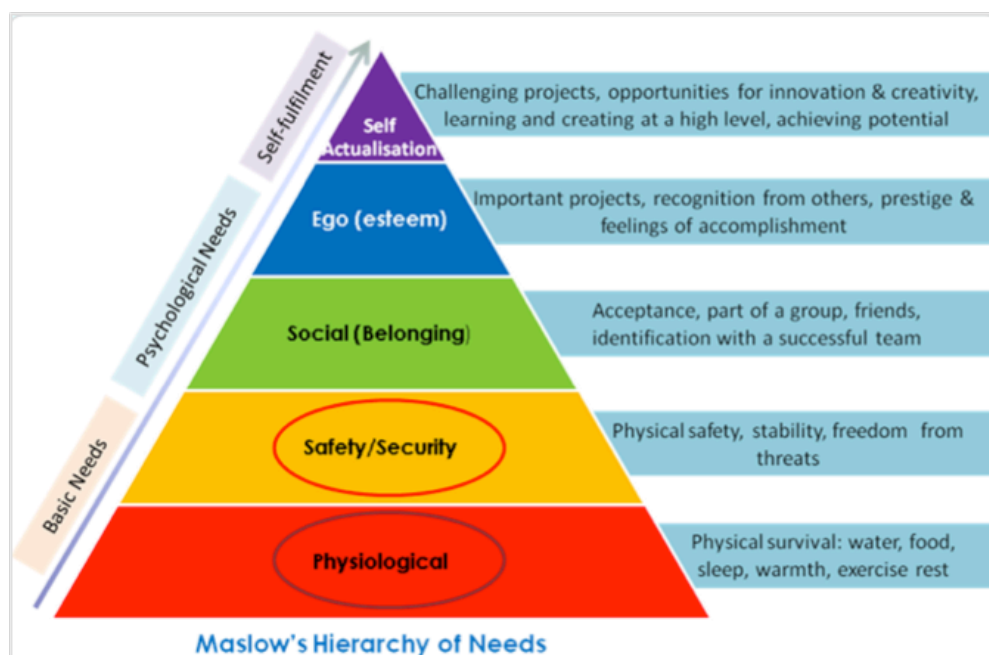
It is everyone's responsibility; everyone who comes into contact with children and their families and carers has a role to play in safeguarding children. In order to fulfil this responsibility effectively, all professionals should make sure

their approach is child-centred. This means that they should consider, at all times, what is in the best interests of the child.

Online safety is included under the Safeguarding umbrella heading - an effective approach to online safety empowers a school or college to protect and educate the whole school or college community in their use of technology and establishes mechanisms to identify, intervene in and escalate any incident where appropriate.

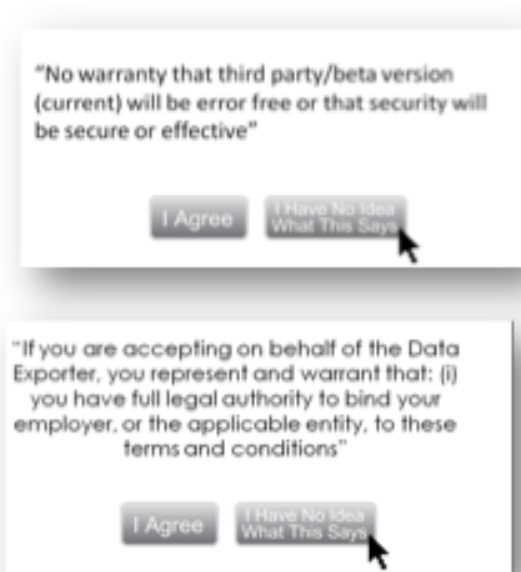
Parents and carers generally choose a school where their child will be safe and secure so that they can learn. Indeed, the primary purpose of security is to protect the child from strangers and unauthorised individuals and many schools have a mission statement that describes provision of a secure, caring, and enriching environment that promotes learning and the development of the whole child. The Framework for the Early Years Foundation Stage (EYFS) states "Children learn best when they are healthy, safe and secure, when their individual needs are met, and when they have positive relationships with the adults caring for them" which includes maintenance of records, policies and procedures.

Parrett and Budge (ASCD. 2012) describe that to learn, children and adolescents need to feel safe and supported. Without these conditions, the mind reverts to a focus on



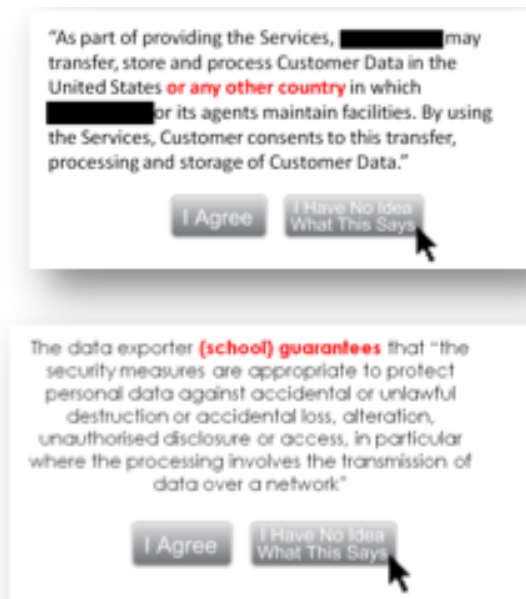
survival. The key principle of continuous improvement acknowledges that the work is never completely done - and asks questions such as "Is our school safe?" to guide actions: A school must be safe. Creating this condition requires thoughtful and constant attention to the security

and safety of the facilities; creation of clear policies and procedures for student and staff conduct; frequent and effective communication with parents, families, and the school community; and attention to classroom management as well as the requisite professional development. Without



found that despite there being a statutory requirement for all schools to have a Data Protection Policy under the Data Protection Act of 1998,

- Many still struggle to navigate the legal and moral maze.
- Are ignorant of the potential harm to children/pupils if their



these conditions in place, learning cannot become a school's focus.

“Learning is primal. As one of the most basic human behaviours, learning occurs instinctively at all times. Our minds actively engage new ideas, new facts, & new behaviours, allowing new truths & principles to be applied in our lives. Humans continuously seek information about circumstances they encounter to help make meaning of what they have experienced. Learning is not only primal; it is constant & significant; survival is at the primal core of learning.” [Shuck, Albornoz and Winberg; 2016].

Sugata Mitra (2013) described the context for deep learning thus; “We need pedagogy free from fear and focused on the magic of children's innate quest for information and understanding”

Safeguarding and data

Online safety is usually considered to be the way we educate children to stay safe on the internet and when engaging with social media. We teach them never to tell any stranger their personal data such as name or address or school or date of birth. How then do we justify this, when numbers of schools give away whole databases that can identify pupils, to perfect strangers?

South West Grid for Learning Trust <https://360safe.org.uk/> surveyed 4628 schools regarding data privacy policies and

data is misused or not kept private.

- Evidence of clear blunders by schools in legal compliance and in maintaining good practice in the storage and use of electronic data.

Whilst schools are well aware that the Data Protection Act 1998 places duties on organisations and individuals to process personal information fairly and lawfully, it seems for some schools that this is somehow separate from safeguarding duties.

“The industry's interpretation of the trusted computing idea is ... to find threats and to make computing trustworthy. The main difference is that you cannot decide by your own what is trustworthy, and what is not. Because they already decided for you. And they already decided not to trust you. So, if they don't trust you, why should you trust them?”
Media Influencer Blog/Adriana

A survey by the Information Commissioner's Office (unpublished, 2015) found that fifty four percent of teachers had not read or did not understand the terms and conditions (T&Cs) to which they had agreed on behalf of their school when using apps or cloud computing. In July 2017, 22,000 people agreed to clean toilets for wireless connectivity because they didn't read the terms. Tim Berners-Lee cited one of his biggest concerns as the increasingly dense terms of service agreements – which can be 54 or more pages long - that companies ask users to

sign; and a public wireless company has demonstrated just how dangerous those complicated agreements can be by inserting absurd conditions that thousands of people unwittingly agreed to.

The company held a two-week experiment in which it inserted a “Community Service Clause” into its terms of service agreement. More than 22,000 people signed up to perform 1,000 hours of menial labour including clearing animal waste, hugging stray animals, clearing sewers, cleaning portable toilets and so on for the chance to connect. There was also a prize offer for anyone who contacted the company and pointed out the clause. Only one person received a prize.

This was a campaign to raise awareness about the necessity of reading the terms of service, and a marketing act to announce that the company is the first wireless provider to be compliant under the new General Data Protection Regulation (GDPR).

GDPR and the Data Protection Act

Following a two year period for organisations to prepare that started in May 2016, the GDPR guidelines will become enforceable on May 25, 2018 for countries that are part of the European Union. The new regulations are intended to simplify terms and conditions as well as provide more transparency for consumers to understand how their personal data will be used.

There are clear messages for schools from other sectors regarding protection of data – in July 2017 the Information Commissioner (ICO) reported that the Royal Free London NHS Foundation Trust did not comply with the Data Protection Act when it turned over the sensitive medical data of around 1.6 million patients to Google DeepMind, a private sector firm, as part of a clinical safety initiative, and suggested that there are four lessons to be learnt;

1. It's not a choice between privacy or innovation. The shortcomings were avoidable. The price of innovation didn't need to be the erosion of legally ensured fundamental privacy rights.
2. Don't dive in too quickly. Carry out a privacy impact assessment as soon as practicable, as part of your planning. This will help you to meet legal obligations and public expectations.
3. New cloud processing technologies mean you can, not that you always should. Consider whether the benefits are likely to be outweighed by the data protection implications for your patients (pupils).

4. Know the law, and follow it. Just as you wouldn't ignore the provisions of the Health and Social Care Act, or any other law, don't ignore the Data Protection Act: you need a legal basis for processing personal data.

The General Data Protection Regulation (GDPR) will give people more control over their personal information when it is passed into law in 2018, superseding the UK's outdated Data Protection Act, which was drafted in the 1990s. Headlines screaming “Schools face hefty fines for data breaches under new EU laws” and “Organisations found in breach of the rules could be fined either up to 4 per cent of their turnover, or £20 million – whichever was greatest” are unhelpful, inaccurate and typically, schools are falling into three camps – ignorance, paralysed with fear and pragmatic planning. The GDPR is a regular discussion topic among Naace's ICT Mark schools and as an ICT Mark lead assessor, I have yet to find one that is not progressing sound plans.

Data Protection Act 1998 - summary

The Data Protection Act is the UK law that currently governs how data is looked after by both private and public organisations, including charities. It also lays out the penalties that can be issued by the Information Commissioner's Office (ICO) if the law is broken, also known as the DPA, it regulates the use and protection of personal data.

It was amended in 2003 to give individuals more control over digital marketing communications they receive, meaning they must opt-in to receive emails, SMS text messages etc from an organisation if they've never had contact with it before.

The Act defines personal data as information relating to a living individual or data subject who could be identified from that data or a combination of that data and other information already in possession of the data controller, or which is likely to come into that entity's possession. This also includes expressions of opinion about that person and any intention the data controller or other individual may have in regards to them, and sensitive personal data. This includes data held digitally or on paper such as filing systems.

Data controllers' "data processing" activities are also subject to the DPA's rules. Processing is a very broad term covering plenty of things, but can be thought of as relating to every interaction had with personal data. As the ICO notes, almost any activity concerning data will constitute processing including while it is in transit. There are some core principles

that will be uniform across the EU bloc and UK. For example, when the GDPR applies in the UK from 25 May 2018, it imposes much harsher penalties than the DPA - notably the maximum fine the ICO can currently impose for a breach of the existing legislation is £500,000, whereas under the GDPR that rises to €20 million, or 4% of global revenue, whichever is higher. Brexit will not affect the new law, because any business wishing to trade with the EU in a way that will involve the data of EU citizens must be compliant with GDPR. There are direct obligations on 'processors', not just data 'controllers'. It is worth remembering that personal data is a valuable commodity, attractive for theft, selling and profiling, to mention only three.

Schools readiness - ICT Mark schools have some good practice worth sharing

- They have focus on four key areas;
- Privacy by Design and Privacy by Default,
- 'Notice'
- 'Consent'
- Children's personal data

They have systems and processes in place

- They have appointed a Data Protection Officer
- They have a SIRO team responsible for oversight of data risk, privacy impact assessment & contracts
- Including the School Information Risk Officer (SIRO), Data Protection Officer, eSafeguarding Governor, eSafeguarding/Online Safety Lead, ICT Co, Business Manager/Bursar (good at contracts), Technical Staff
- They have identified these useful App risk questions:
- What does this app do and is it useful? What types of data does it store? Where does it store data? Have there been any known breaches of its data? How do they make their money? (If free, monetisation likely from sale of data). Is data protected in transmission?
- Schools e-mail app or cloud developers to make informed risk judgement, privacy impact judgements and negotiate contracts.
- Use RBC secure cloud services hosted on the UK NEN e.g. LGfL/TRUSTnet's myDrive, USO-FX2, SWGfL's 'Cloud PC' or compliant provision such as PurpleMash
- Risk Assessment / Data Protection
- where is data hosted? Who has access? Data recovery? Encryption?.....
- Consistency
- Ensure policies reference each other or are brought together (Safeguarding <-> Online Safety<->Data Protection)

- They understand that as Data Controller, they are responsible for data even offsite

"Safety shouldn't be about safety, it should be about living and learning. When safety is made into some bureaucratic, legal or club exercise, it has lost the plot.... Safety should be about none of these things. When we put learning first, people first, relationships first, respect first and living first, then we might get to the heart of safety." [Dr Rob Long]

- Taught as a more general life skill? In which curriculum area is it also taught?
- Are you seeing an increase, albeit slow, of the online publishing of students' work and blogging? Is this helping pupils to spot the dangers?
- Facebook's intention to help users spot fake news is a specific instance of digital literacy. How do we best help our students to progress over their school life from using only provided links to complete independence? Do you have any examples?
- Are school safeguarding policies paying sufficient regard to the continuing safety of students into their adult life? Do you have any evidence?
- How widespread is an understanding about copyright, reuse of online resources and things like attribution?

Based on the analysis of the responses to the questionnaire I suggest some deeper questions need to be asked about the current situation:

- Is online safety and digital literacy as well addressed as corresponding issues in the 'real world'?
- What can be done to embed online safety and digital literacy as part of life in all schools?
- What are the most successful models for effective teaching and learning with regard to staying safe online?
- How might students be safely allowed to interact with the risks of the online world without danger?
- What benefits are there in the online publishing of students' work and what do they need to understand to do this safely?
- What is the national picture with regard to students being able to search for information efficiently and what strategies do they have for recognising rogue websites?
- What needs to be done to ensure wider ownership and more unconscious use of safety policies?
- What are the main issues regarding copyright for schools and their students?
- How widely recognised as important is copyright?

We hope that members of organisations like Naace and MirandaNet will share their evidence so that we can develop guidelines about how to proceed. It is a rocky road for

teachers at the moment with no clear guidance. Sharing expertise in a professional organisation can help to lead us all in the right direction.



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