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Embedding Information and Communication Technology across the curriculum – where are we at?

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Abstract

This article aims to deliberate the current position of Information and Communication Technology (ICT) in the English secondary (11–16) school curriculum. The arrival of a new National Curriculum Programme of Study in Computing, and a much greater emphasis placed on computing and computer science, potentially terminates ICT as a dedicated subject and an area of important and significant learning for our pupils. However, could this herald a new opportunity for schools to productively embed ICT across their curricula, thus allocating time for Computing to be developed as the fundamental subject it is required to be while still allowing essential ICT skills and capability to be taught? This article briefly considers historical United Kingdom (UK) approaches to cross-curricular ICT provision. It also presents, and draws some conclusions from, results of broad research investigating secondary teacher colleagues' – and schools' – ability, technical knowledge and capacity in promoting the successful delivery of a focused cross-curricular ICT programme for their pupils.

Keywords: ICT; Information and Communication Technology; Computing; Cross-curricular

Introduction

This article is a continuation and further response in scrutinising the current ICT/Computing curriculum change in England that has previously featured in articles for this journal by Wells (2012) and Morris (2012), and the impact this change could be signifying. The ICT curriculum has been under extensive scrutiny and criticism in recent years, with calls for significant change being mooted. These calls have not gone unheeded and change has transpired at some considerable pace. On 11 June 2012 Michael Gove, the Secretary of State for Education, confirmed that from September 2012 ICT Programmes of Study, associated Attainment Targets and statutory assessment arrangements would be disapplied, thus removing a curriculum that he described as 'too off-putting, too de-motivating, too dull' (Gove 2012). A wealth of new General Certificates of Secondary Education (GCSEs) in Computing and Computer Science have also been launched alongside the creation of a new Computing National Curriculum for first teaching from September 2014. Indeed computing and computer science are now considered essential in a child's education, so much so that on 30 January 2013 Gove announced that Computer Science GCSEs would be included in the science element of the EBacc (English Baccalaureate) (DFE 2013) from 2014 onwards.

But where does this leave ICT? The new Computing curriculum arguably might not provide for much sizeable ICT taught input. While every child should have the opportunity to learn Computing at school, including exposure to Computer Science as a rigorous academic discipline (The Royal Society 2012: 6), ICT is still an important subject and pupils' ICT capability is fundamental to their successful participation and engagement in modern society (QCA 2007). One might argue that children are now far more confident and autonomous users of ICT, but they are unlikely to become the competent and proficient ICT expert users they need to be without focused input in their schools: young people may have grown up with technology but it does not mean they are experts in its use for their own learning (Higgins et al. 2012a: 20). Young people will therefore need continued input in developing and progressing their ICT skills and capability. Computing, however, is the new subject receiving attentive provision in schools. With this in mind, are we ready for the creation of successful cross-curricular models to replace or considerably enhance a dwindling dedicated ICT provision? From a general technology perspective there is little reason why this may not now be facilitated. Equipment today is more cost-effective and far easier to access through a wireless and mobile classroom.

For example, a 'bring your own device' (BYOD) approach is becoming a more viable option in many schools. Indeed, the BESA 2013 *Tablets and apps in schools* report suggests that only 19% of the 305 secondary schools surveyed would not consider a BYOD option. It is also arguably becoming harder to suggest ICT cannot, in some way, have an enriching impact on learning. This is conveyed with clarity, for example, through the ImpaCT2 (DfES 2001) investigation into the consequences of ICT on educational attainment. In Science for example, a high ICT user's test performance was 0.56 of a GCSE grade higher than a low ICT user's. This figure rises to 0.82 of a grade in Modern Foreign Languages. These are 'old' statistics but they still carry considerable weight in presenting the significance and importance of ICT in a school's curriculum and a young person's potential attainment outcomes. If over a decade ago ICT had this impact it is plausible to suggest it still should.

Historical UK cross-curricular ICT

Embedding ICT across a school's curriculum is not a novel concept – or at least attempting to do so is not. During the last 15 years there have been concrete attempts to implement a cross-curricular programme. In 1997 the UK government affirmed its election manifesto commitment to education by announcing considerable investment in school ICT infrastructure through the National Grid for Learning (NGFL) strategy. This equated to a total 1998–2004 spend of £1.8bn (Ofsted 2002). In turn, the New Opportunities Fund (NOF) training initiative was established in 1999, with £230m of UK Lottery funding made available to help raise the competence of all teachers in their use of ICT in teaching and learning (Ofsted 2002: 2). In 2004, as part of the UK's National Strategy for whole school improvement, the 'ICT across the curriculum' (ICTAC) initiative was launched. This brought with it an objective of developing coherent and effective ICT practice across the curriculum by attempting to provide pupils with opportunities to apply and develop their ICT capability across all subjects (DfES 2004).

These programmes enjoyed some success. The ImpaCT2 longitudinal study evaluating the NGFL transformational strategy clearly demonstrates in all subjects investigated (English, Maths, Science, Geography, Modern Foreign Languages and Design and Technology) that those pupils recognised as high ICT users outperformed, on average, the low ICT users (Becta 2002). Successes were also experienced in the NOF training programme where teachers who completed the training made significant steps in raising their standards of ICT (Preston 2004). Ofsted (2005) in its *Embedding ICT in schools* report clearly stated that ICT confidence and competence of staff had improved and that most schools were at least affording satisfactory provision for ICT across subjects. However, despite these apparent gains and achievements it was still evident that the accomplished embedding of ICT in curriculum subjects was variable and inconsistent and 'in most schools ICT had not yet become integral to teaching and learning' (Ofsted 2005: 3). Furthermore, the successful integration of ICT into subject teaching still depended on the confidence and skills of the teacher – suggesting staff ICT capability issues had not been productively met across all schools. This argument can also be seen in part one of the NOF evaluation report (Preston 2004) where barriers to successful learning about ICT's use in the classroom existed due to a lack of basic ICT skills.

Thus, despite considerable investment in resources and training, perhaps historically the development of ICT across the curriculum has been somewhat sporadic and incoherent in its progression. As Dixon & Tierney (2012: 11) state, 'The ability to scale the development of confident users of technology across whole school staffs has, to date, been a major weak point'. Admittedly this quote is from a publication that may not be UK-specific, but the suggested reality is that this may often be very true of too many English schools and their teaching personnel, and it is vital to ensure that teachers remain equipped to teach pupils fundamental ICT skills (Morris 2012).

Moving forward

So, regardless of the historical input described, it is debatable whether enough teachers are equipped with the required confidence, competence, pedagogy and perhaps motivation to initiate successful technology and ICT-enhanced learning in their subject discipline. Current teachers conceivably may not be classified as 'digital natives', but perhaps more so as 'digital immigrants' who assume learners learn in the same way they always have (Prensky 2001). Convincing many of these to incorporate ICT within their lessons with real impact or focus may be tricky. Kenny & McDaniel (2009) posit that teachers may view technology or certain technologies as 'fads' that will be replaced by newer fads and therefore stand little chance of being understood or adopted as a useful educational tool. Another problematic concern is that it's not just about the teacher's skill of being an excellent ICT practitioner. Just having ICT 'nous' and being resource-effective and proficient may not really be good enough. Teachers who use ICTs are

not necessarily adjusting their pedagogy to meet the requirements of this technology (Madden et al. 2005). 'Using ICT effectively in schools is about more than changing resources; it is about changing practice and culture' (Condie & Munro 2007: 8); and 'it's the pedagogy not the technology' (Higgins et al. 2012b: 3) that matters – meaning that how you use the ICTs in contributing to the enhancement and enrichment of learning is far more important than the ICTs themselves. Longevity of ICT impact is accomplished through the ability of the teacher to integrate or embed ICT into the learning experience of their pupils in such a way that the potential of the technology is fully realised (Condie & Munro 2007: 63). Teachers need to understand and 'buy into' the value of ICT use in the learning experiences of their pupils and work to create appropriate depth and challenge to their pedagogical approach in the use of their chosen technologies – in addition to planning for content within their own subject designation. Therefore moving towards a more complex learning environment, focused on delivering enriching and attainment-strengthening ICT alongside required subject provision, could prove complicated and problematic for many schools and the individuals therein.

However, The Royal Society's (2012) proposal of creating three strands incorporating Computer Science, Information Technology (IT) and Digital Literacy appears to be a model that is being adhered to in schools. Computer Science may be adequately addressed through the new Computing National Curriculum (2014) but ICT and digital literacy (although there) potentially far less so. It is less apparent how these two strands may be taught. They could be incorporated into the discrete computing curriculum, but arguably they could also be taught by other subject teachers; or of course, perhaps rather worryingly, they may no longer be delivered. If ICT is still to be recognised as an important area of learning by schools, educators, education and industry then teachers may have to be ready to incorporate ICT tools with improved impact if we are to sustain its delivery and the scholarship required of it. Increased levels of teacher ICT capability and pedagogical expertise may therefore be called for, but do they currently exist?

Research method

The research involved non-ICT/Computing London-based teachers (n = 75) and was conducted in predominantly east London (UK) secondary schools. Colleagues were asked to complete an online survey designed to investigate their ICT skills, capability and perceptions. The survey was accessed by participating colleagues between October 2013 and February 2014. A number of the questions also allowed for further development of the answers to gain an additional qualitative insight into their ICT understanding and ability to integrate into their own subject area of expertise. Teachers from various main scale and leadership positions completed the questionnaire. Over 21 curriculum subjects were represented and Key Stage representation was balanced. Appropriate permissions and ethical considerations were taken into account and adhered to and participants' responses remained anonymous.

Research findings

The research was conducted in the following fields of ICT understanding and capability, with a number of specific questions asked within each of these broad areas:

1. Basic technical know-how
2. Word processing and desktop publishing
3. Presentation, graphics and multimedia
4. Internet/e-mail
5. Data handling
6. Use of ICT for learning
7. Planning, teaching, assessing and evaluating with ICT
8. Use of interactive whiteboards
9. Level of access to ICT facilities

For the purposes of this article, data analysis will be approached in a generalist way and findings will be presented in broadly interpreted and discursive terms. The research findings are presented below.

1. Basic technical know-how

Highly confident/confident	84%
Not confident/lack confidence	16%

Participating teachers felt they were confident and competent in this category. Strengths can be seen in the data where the majority of respondents are, for example, able to connect up a computer and its peripherals, save and download information, access network shared areas and connect to wireless networks. What is less clear is the ability to install software and hardware, where 23% and 25% respectively felt some lack of or no confidence.

2. Word processing and desktop publishing

Highly confident/confident	84%
Not confident/lack confidence	16%

Again responses were generally very favourable. Apparent strengths can be drawn from the survey participants' ability to use word-processing and desktop publishing platforms and there is comprehensible perceived competence in the general use of the software. However, more complex facets were not as positively defined. For example, 46% did not feel confident in using mail merge facilities. Creating hyperlinks also presented a problem, with 27% unclear how to link to external content from a document they were creating. This increased to 43% who were unclear how to link to content within a document.

3. Presentation, graphics and multimedia

Highly confident/confident	76%
Not confident/lack confidence	24%

Responses to the questions asked in this field are more varied. Confidence can be observed in the more basic attributes of the software and it is reasonable to assume from the data that teacher colleagues are able to work within digital presentation and graphic environments. However, certain facilities are conceivably less understood. For example, 43% lack or have no confidence in their ability to use a digital device to record sound. Over 57% lacked or felt they had no confidence in using movie editing software. Perhaps rather more interestingly, the use of certain presentation software features proves problematic, with 23% uncertain about adding sound and animation to slides and 41% lacking or have no confidence in adding video content to slides.

4. Internet/e-mail

Highly confident/confident	80%
Not confident/lack confidence	20%

Respondents clearly have confidence in an internet and e-mail facing environment. Confidence, however, can be seen to be lacking in elements of web design and publishing. Of slightly more concern is that 30% lack understanding in changing internet settings and 33% are lacking/not confident regarding copyright issues when using web-based resources.

5. Data handling

Highly confident/confident	52%
Not confident/lack confidence	48%

Understandably perhaps, the more computing-focused database development and use questions were answered with less confidence. Arguably the more ICT-facing spreadsheet understanding is also lacking. 44% were lacking/not confident in producing graphs. 40% were lacking/not confident in formulae use. 41% were lacking confidence in using filters and 53% were lacking/not confident in using spreadsheet data to make predictions. Not only does this offer significant doubt regarding spreadsheet use in a learning environment, it also raises concerns regarding teacher colleagues' ability to interact with and interpret data in a digital setting.

6. Use of ICT for learning

Regularly	36%
Sometimes	17%
Infrequently	17%
Never	29%

Results here are very mixed. 90% of respondents will use websites, at least occasionally, as learning resources and 88% will also make use of online resources. 98% use generic software as part of their administrative approach and organisation. However, 68% will infrequently or never use blogs as a teaching resource. Although 55% are regular social media users, 44% of respondents never use it as a learning resource. 31% infrequently use podcasts and 47% never do. 62% never publish resources to YouTube and 38% never publish resources to their school's virtual learning environment either. Perceivably, from this survey at least, digital literacies are not being as successfully embedded in a curriculum as they could be.

7. Planning, teaching, assessing and evaluating with ICT

Highly confident/confident	63%
Not confident/lack confidence	37%

Contrasting results are recorded. 91% of respondents were at least confident in understanding the relevance of using ICT as a tool to enhance the learning of their pupils. 84% felt confident/highly confident in planning for focused ICT use and 66% felt they could extend the learning in their subject through the use of ICT. However, 36% were not confident in using their school's virtual learning environment (VLE) as an ICT resource to support ICT learning delivery in their

subject areas. Furthermore other obstructions appear to exist in allowing colleagues to use ICT as a teaching and learning tool. For example, Colleague A would like to plan for ICT use but finds the 'limited resources in school' a huge barrier.

8. Use of interactive whiteboards

Highly confident/confident	52%
Not confident/lack confidence	48%

Despite the use of interactive whiteboards (IWBs) in our schools being prolific, it is perceivably evident that they are not being used to their full potential beyond, perhaps, their use as a 'screen' for the multimedia facilities to project onto. There is a lack of understanding in engaging with additional facilities that IWBs offer. For example, 28% lacked confidence in using basic IWB tools such as the pen, highlighter and eraser. 70% lacked confidence in using text conversion and display 'recording' tools and 60% lacked confidence in creating resources for use with an IWB. The suggestion is that it is not just confidence that is lacking, but debatably these tools and IWB uses are not understood.

9. Level of access to ICT facilities

Access	54%
Limited access	30%
No access	15%

Access to appropriate facilities represents some issues. Whereas respondents (95%) felt they had easy access to a computer to prepare lessons and administer their role, access to facilities in their classroom becomes more problematic. Limited/no access to computers/laptops for whole class teaching equates to 67% for example. 60% have limited/no access to a digital camera. This compares to 64% when considering a video camera. Perhaps more worrying is that 64% suggest they could struggle to create/access a wireless connection for pupils' own devices – suggesting a BYOD approach may not be so viable after all. Equally, 59% suggest that support for their use and incorporation of ICTs into their lessons is lacking. This can also be evidenced through some of the commentary from respondents where more than one colleague, for example, has proposed that access to facilities is limited or non-existent and the only software available is Microsoft Office.

Conclusion

This article has sought to discuss historical UK approaches to cross-curricular ICT provision. It has presented some general conclusions from results of broad research investigating secondary school teacher colleagues' ability, technical knowledge and capacity in promoting the successful delivery of a focused cross-curricular ICT programme. The suggestion is that ICT and Digital Literacy learning is provided for in the new (2014) Computing National Curriculum (for English local authority maintained schools). However, many ICT/Computing departments may concentrate their efforts on the more complex Computing and Computer Science elements – areas where teacher confidence and competence may be lacking – to the detriment of ICT and Digital Literacy engagement. With this in mind, are our schools able to really begin to incorporate ICTs in other subjects of their curriculum?

What is interesting and encouraging to note is that 89.5% of teachers felt that using ICT would enhance and enrich the learning experience of their pupils. Equally hopeful is that 82% were actually interested in using ICT in their lessons. Thus the beginnings of a successful cross-curricular ICT model may be a blossoming and viable option. However, the research does present a mixed set of results. Whereas there does appear to be a certain level of competence in using ICT tools among the respondents, further training and development may well be of benefit to ensure these competencies add the focus, expertise and pedagogical know-how for considerable ICT learning impact to be gained. What is also apparent is that barriers to using ICT and technology-enhanced learning media, in lessons outside the traditional discrete ICT curriculum, still exist. There is the competence-based barrier as discussed above, but also access barriers whereby colleagues may be unable to sufficiently engage with ICT resources – as Colleague B suggests, 'it is impossible to book ICT facilities' or as Colleague C posits, 'we have very little to no access'. There are barriers that can be drawn from the limited resources available in the school or curriculum area and perhaps the support in obtaining new resources. There are perceived cultural barriers – as Colleague D proposes: 'ICT was used in my previous school. There is less of a culture in my current department.' There are suggested barriers regarding the lack of consistency of ICT resource procurement – for example, schools having a mix of Promethean and Smartboard technology in their classrooms. For ICT and Digital Literacy to become increasingly embedded in a curriculum, a 'top-down/bottom-up' approach is required.

The school's governing body and senior leadership team have to believe that ICT can and will enhance the learning of their pupils; but so do the teachers –

thus removing or at least reducing potential barriers. If this consensus of agreement and consistency of opinion can be reached then the likelihood of seeing the focused use of ICT in the classroom increases considerably and Computing teachers can focus on the business of delivering a purposeful and productive computing and computer science curriculum.

References

British Educational Communications and Technology Agency (Becta) (2002). *ImpaCT2: the impact of ICTs on pupil learning and attainment – Summary Report*. Coventry: Becta.

British Educational Suppliers Association (BESA) (2013). *Tablets and apps in schools 2013. Full Report*. London: BESA.

Condie, R. & Munro, B. (2007). *The impact of ICT in schools – a landscape review*. Coventry: Becta.

DFE (2013). 'The English Baccalaureate'. Online: http://www.education.gov.uk/schools/teachingandlearning/qualifications/englishbac/a0075975/the-english-baccalaureate [accessed 27 June 2013]

Department for Education and Skills (DfES) (2001). *ImpaCT2: emerging findings from the evaluation of the impact of ICT on pupil attainment*. London: DfES.

DfES (2004). *ICT across the curriculum: Management Guide.* London: DfES.

Dixon, B. & Tierney, S. (2012). 'Bring your own device to school'. Microsoft http://www.pcpro.co.uk/news/education/382006/schools-warm-up-to-byod-for-tablets [accessed 27 June 2013]

Gove, M. (2012). 'Speech at the Bett Show Jan 2012', Gov.Uk. Online: https://www.gov.uk/government/speeches/michael-gove-speech-at-the-bett-show-2012 [accessed 27 June 2013]

Higgins, S., Xiao, Z. M. & Katsipataki, M. (2012a). *The impact of digital technology on learning: a summary for the Education Endowment Foundation Full Report*. Durham University.

Higgins, S., Xiao, Z. M. & Katsipataki, M. (2012b). *The impact of digital technology on learning: a summary for the Education Endowment Foundation Executive Summary*. Durham University.

Kenny, R. & McDaniel, R. (2009). 'The role teachers' expectations and value assessments of video games play in their adopting and integrating them into their classrooms'. *British Journal of Educational Technology*, 42 (2), 197–213.

Madden, A., Ford N., Miller, D. & Levy P. (2005). 'Using the Internet in teaching: the views of practitioners (a survey of the views of secondary school teachers in Sheffield UK)'. *British Journal of Educational Technology*, 36(2), 255–80.

Morris, D. (2012) 'ICT and educational policy in the UK: are we on the way towards e-maturity or on the road to digital disaster?' *Research in Teacher Education*, 2 (2), 3–8. Available at: www.uel.ac.uk/rite/issues/vol2/2/pp3-8/

Office for Standards in Education (Ofsted) (2002). *ICT in schools: effect of government initiatives*. London: Ofsted HMI.

Ofsted (2005). *Embedding ICT in schools – a dual evaluation exercise*. London: Ofsted HMI.

Prensky, M. (2001). 'Digital natives, digital immigrants'. *On the Horizon*, NBC University Press, 9(5).

Preston, C. (2004). *Learning to use ICT in classrooms: teacher' and trainers' perspectives. Part one. A summary of the evaluation of the English NOF ICT teacher training programme 1999–2003*. London: MirandaNet.

Qualifications and Curriculum Authority (QCA) (2007). *ICT programme of study for Key Stage 3 and Attainment Target.* London: Qualifications and Curriculum Authority.

The Royal Society (2012). *Shut down or restart? The way forward for computing in UK schools.* London: BCS.

Wells, D. (2012). 'Computing in schools: time to move beyond ICT?' *Research in Teacher Education*, 2 (1), 8–13. Available at: www.uel.ac.uk/rite/issues/vol2/1/pp8-13/

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