

NAACE

THE EDUCATION TECHNOLOGY ASSOCIATION



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Back To The Future: in Education Innovation
A collation of research findings spanning 20 years that have enduring relevance

Advancing Education. The Naace Journal. Autumn, 2021

A letter from the chair of Naace

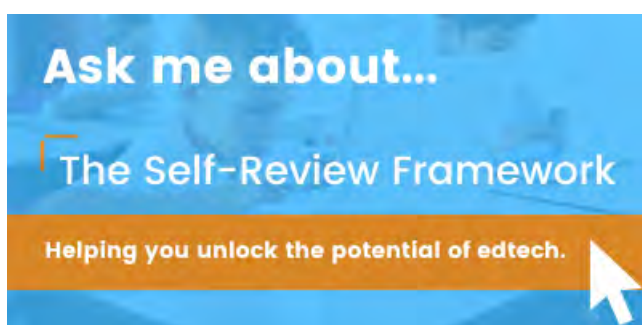
Dear Naace members

This edition of Advancing Education takes a “back to the Future” perspective of innovation in education and explores the emergence of the use of technology since the turn of the century, not only in terms of a chronological record, but as a valuable insight of the thought and potential expressed over this period. Christina has expertly curated a narrative that allows us to understand better how we have arrived at where we are today but also forces us to reflect on whether today’s landscape benefits from the actions, thought, plans and advice that have sought to steer the use of Educational Technology in the UK over this period. In this sense it is not a comfortable read. Christina’s narrative and the articles inevitably leave us with many questions and very often these are questions provoked by frustration or concern about our current sense of progress and sense of future.

This edition will be both enlightening to those who have more recently joined the EdTech debate and serve as a touchstone for those that have been engaged in the longer campaign. The narrative is both thoughtful and revealing and the questions the publication will inevitably precipitate need to be considered by all.

Naace is pleased to confirm that the association will have a presence at BETT 2022. It must be true that there has never been so much impacting the use of educational technology in the interval between BETT shows, In the context of the past two years and considering the content of this issue of Advancing Education, Naace is exploring options for creating opportunities for the members to share their experiences and thoughts. There will be more on this in the Xmas edition of the newsletter. In the meantime, make a note in your calendar to attend the AGM and come by the Naace stand (NA90) to catch-up with the Board..

*Your sincerely,
Laurence Boulter
Naace chair*



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EDITORIAL

Professor Christina Preston

BACK TO THE FUTURE

“Every student needs a grandparent to link them to the past and a PC to take them into the future.” (UK01-Greenfield)

Before 2010

In this journal edition we look at the context of change since the turn of this century as it relates to digital technologies.

One of the researchers who has most influenced the teaching profession's approach to change has been Michael Fullan (1993, 2001). He wrote extensively on school change, approaching diffusion by focusing on the conditions that foster large-scale reform grounded in local ownership. Central to his concerns are whether the people most affected by a change can find meaning in it. He emphasised complexity, conflict and diversity, uncertainty, and multiple theories of change. He saw fragmentation and overload as the biggest problems that schools face.

The history of Naace goes back to the 1980s. Members like myself remember those early days when we were struggling to understand what computers could do for society. Given they were difficult to use at the beginning I often struggled to see the point. And, like many teachers asked to teach this new subject, Information technology (IT), I had had no training in computing at all at school or at university, since computers were not available for general use.

In fact, my degree was English, Drama and Telecommunications but the latter was largely about film and video. My first involvement as an IT teacher via BT was an invitation to design the first adventure game for schools to teach children about IT devices. When I looked at the commercial games on the market my question was, where are the Shakespeares of software? I found the technicalities of killing myriad opponents on the screen interesting, but the motivation was hard to fathom. I was not impressed.

So with a group of other South London teachers of all disciplines we set about designing an adventure called Scoop. Here the student took the role of a journalist using information technology devices to catch up with a recluse millionaire. Our second adventure game was for groups of children representing journalists in different countries grouped round a computer screen in the network room. If the children used the internal communications to share information about the notorious international criminal, Slick Cut, they would

Professor Christina Preston

Dr Christina Preston, a member of Naace for 28 years, joins the Naace Board of Management from an academic background, offering the association a great deal of insight



into research about education technology and also effective professional development programmes for teachers. As a retired professor of education innovation she brings an international slant to Naace as she has worked with teachers and researchers in Argentina, Brazil, Chile, China, the Czech Republic, India, Mexico, Pakistan, Saudi Arabia, South Africa and Syria. This led her to create a professional organisation, the MirandaNet Fellowship, which seeks to explore the integration between edtech learning and practice. Christina has plenty of experience in providing advice – both academic and practical – to curious education practitioners. As the Editor of Naace's *Advancing Education Journal*, Christina plays a pivotal role for the association in organising, collecting and reviewing relevant academic material which will benefit the association's membership.

find that last month he had bought the chip factories in South America that provided the chips for their computers and last week he bought the paper mills in Sweden that provided the paper for the newspaper called the Daily Gazette - and yesterday he bought the newspaper. What were they to do with all the information they had gathered about his nefarious international activities and his wicked relatives?

A valuable discussion was encouraged by the teachers exploring the early issues of digital literacy. At that point in the 1980s we did not have access to the internet in schools but it was a valuable warning about the benefits and the dangers of this new form of digital communication that was about to engulf us (Preston 1994).

From the early 1980s to 2010 the UK was widely praised for the early research and practice that we shared across the world. Government agencies like the Teacher Training Agency and Becta were fully engaged in funding research programmes where we tried to assess the impact of computers and to explore professional development programmes for teachers that would keep them ahead of the game. Indeed, in 2004 I was commissioned to research the impact of a country-wide training programme for teachers in educational computing funded by the Teacher Training Agency (TTA): the first in the world.

Between 1999 and 2003, 80% of the UK's 450,000 teachers had completed the New Opportunities Fund's (NOF) £230 million programme on Information and Communications Technology (ICT) undertaken by forty seven Approved Training Providers (ATPs).

The programme's planners broke new ground in three ways: commercial companies were invited to link with university education departments, local authorities, independent advisors and teachers to provide training; the programme was to cover classroom applications of ICT, not basic skills; and online learning was emphasised, to introduce teachers to the National Grid for Learning (NGfL).

Controversy began when the Times Education Supplement questioned the quality of courses, and Ofsted began to question the learning outcomes. In fact, these early warnings triggered substantial improvements. Because of the controversy surrounding this programme, the MirandaNet evaluation that I led, completed during 2002-2003, aimed to present a balanced report, reflecting the multiple perspectives of teachers, teacher leaders, trainers, inspectors and policy makers.

So what did we find? Here are some findings that have resonance in some situations today:

- A key issue was the significance of school culture and leaders' attitudes towards ICT. No progress could be made unless the professional vision was agreed within the school, and positive action taken to embrace the programme, including effective, whole school needs analysis.
- The choice of trainer and the working relationship with the school were also central. Overall there was little evidence of online learning and e-mentoring as the NGfL infrastructure was not complete, and those web based learning environments that were used were overloaded.
- Measuring achievement was difficult. Accreditation was neither required under NOF regulations, nor popular among teachers. Trainers operating rigorous accreditation lost out when teachers only completed four fifths of the course and accreditation standards, where they existed, varied considerably. Collegiality began to emerge later in the evaluation, reflecting newer thinking about the building of learning communities and knowledge bases, and one form of accreditation involved web-portfolios from which other teachers could learn (Preston 2004).

Most of the conclusions from this study are equally valid in 2021, which is my point. Any teacher training team would do well to study the issues that came up when the UK was putting significant funding into finding a way forward in digital teaching and learning - a field where we were leading. This would contribute

so much to creating education technology programmes that work today.

Post-2010

So why was 2010 significant? Well, many Naace members will remember that in the first week of the new Tory government, Michael Gove, the then Minister of Education and Dominic Cummings, a government adviser, disbanded Becta and the TTA citing austerity. However, what was not anticipated by the profession was that these websites that were used throughout the world would be confined to a government repository where searching for reports was problematic. In addition, Gove said that Britain had had enough of experts and dismissed academics and civil servants as 'The Blob'. In addition, the new Department of Education intake did not aim to work as closely as they had in the past with the professional organisations like Naace, ITTE, MeshGuides and the MirandaNet Fellowship that represented a large percentage of Information and Communication Technology professionals in the schools and the universities.

This desire to undo the achievements of the political party before them is not confined to the UK. We all know of more dramatic methods through history by actually burning the books instead of just switching off a website. But in his review of the new book, *Education System Design: Foundations, Policy Options and Consequences* (Hudson, Leask and Younie, 2021) David Kerr, University of Reading, calls on educators to realise that the values that underpin our democracy and its institutions including schools, are under a growing threat from the forces of globalisation. This is where the professional organisations that represent education technology have a vital role.

But in the UK the general contempt for experts seems to be on the wane. Perhaps this is a result of listening to the Covid experts. Anyway more informed Ministers are being engaged in this field and ex-members of Becta are now being employed in the Department of Education. So this journal edition departs from the traditional mode as we are presenting a campaign by the professional organisations to reassemble the research before 2010.

Active readers

Even Google cannot tell me who first said, "Prediction is difficult, especially of the future." Nevertheless there must be some value in looking back to the findings of yesteryear when funding was better and the vision was predicated on the national picture. We are asking you as Naace readers to be active in engaging with these past research reports that have been sent to us: mulling over what is still true today, what is now old hat and what can be modified to inform the design of new programmes for teachers and their students.

In the section, **Looking forward from 2000**, the first report from the Organisation for Economic Co-operation and Development (OECD) is certainly poetic and hopeful in its hopes for the future that can only be guessed at. "Whether we embark, like a Star Trek adventure, into new and uncharted realms of teaching and learning or circle again and again over the already explored terrain of traditional education is a function not of the power of ICT but of our creative imagination". What a task they set us! (Venezky and Davis 2002a).

In their second report, **Quo Vademus: Where are we going?** Venezky and Davis (2002b) look closely at how their research informs schools in their planning for the future. The approach of this report was to examine ways in which technology presents opportunities to mediate learning interactions and then identify key contextual themes that shape the realisation of these opportunities. Capital presented four examples that each illustrated the opportunities which novel digital tools bring to support learning. These examples, whilst justifying optimism regarding the potential of new technologies, also highlighted various contextual factors that constrain this potential.

In the section, [Looking backwards to see forwards](#), Anne Marcus-Quinn and Colin Harrison have accepted the invitation to offer their own interpretation of how research from the past has had an impact on our current situation. Marcus-Quinn reflects on how Covid-19 has shone a spotlight on the barriers to accessing a high quality education online.

Colin Harrison explores the value of [Becta's ImpaCT2](#) report, also produced in 2002. The approach of the report was innovative at that time: developing novel research methods to investigate pupils' ICT activity in and out of school, and what was gained from such use; developing and applying new statistical methods for analysing the relationship between the effective implementation of ICT and standards of performance of pupils on national tests and GCSEs; and exploring the nature of teaching and learning in and out of school, with a particular focus on teacher learning and development.

The 1990s - 2010s were exciting times because the digital tools were developing so fast. In the section, [Digital Tools and Resources](#) we cover a series of complementary reports funded by a Becta series called Harnessing Technology. In the first report from the project, [CAPITAL: Curriculum and Pedagogy in Technology Assisted Learning series funded by Harnessing Technology](#), the researchers aimed to focus on identifying how to maximise the potential for technologies in schools. Doing so required a good understanding of the contextual variables, mediating this potential and the strategies for addressing these. Their recommendations reproduced here are focused on this approach.

A second report in the [Becta Harnessing Technology series, ICT tools for Future Teachers](#), (Leask and Preston 2009) aimed to provide Becta with research-based advice to support effective ICT use by teachers now and in the future. The research underpinning this report was focused on five questions that could form a companion study in the 2020s:

- What in the views of practitioners, are the characteristics of effective technology-based tools and resources and how do they help teachers do their work well?
- What are the characteristics of effective non-technology based tools and resources and how do they help teachers do their work well?
- Where do practitioners go to find out about and access new tools for learning and teaching? What are the key challenges faced by practitioners in doing their job well?
- Which ICT tools would help in the future? What digital solutions would be needed? If these solutions do not exist, could they be created? What would their characteristics be, and how and when would they be used?

In the last section about [Professional Development](#) I cover the summaries of two of three interrelated reports about the ICT CPD Landscape funded by Becta. The first report in the Continuing Professional Development in ICT for teachers series is an academic literature review that is cited in the references for the specialist academic (Daly, Pachler and Pelletier, C. 2009a). The second report on the different kinds of Continuing Professional Development contexts and models in ICT available for teachers, that is summarised here, concludes that the ICT CPD landscape is subject to many powerful influences, including commercial interests, the demand to showcase high-profile technologies and the competing CPD agendas driven by high stakes testing which can inhibit pedagogical development. Despite all this, there were clear messages about the features of effective CPD and what it takes to develop them (Daly, Pachler and Pelletier, C. 2009b). The third Landscape study report that is summarised here reports on Information and Communications Technology (ICT) Continuing Professional Development (CPD) programmes that were actually available to teachers across England in 2009/2010. This report also contains a section about

teachers who are reluctant to use learning technologies in classrooms that indicates that unenthusiastic teachers had some valid points to make at that time (Pachler, Preston, Cuthell, Allen, A. and Torres, 2011)

Lastly we have three relevant **book reviews** both published in 2021. This first is called Ensuring Schooling for All in Times of Crisis: Lessons from Covid-19 (Leask and Younie 2021). As the reviewer, Irma Orloff, says, "The fact that a volume of this magnitude could be produced within this timeframe, during a global pandemic, in and of itself qualifies the editors and contributors of this book as leading scholars on the futures of education." This is a pleasing tribute to researchers who have continued to question and to explore how digital technologies impact on education.

The second book for 2021 is amazingly published again this year by two of the same authors, Education System Design: Foundations, Policy Options and Consequences (Hudson, Leask and Younie, 2021). Further in his review David Kerr also remarks that the book recognises the urgent need to conceptualize education, including including the role of citizenship education in ways that provide young people with the knowledge, skills and values not only to promote democracy but to protest and defend it. This is where digital literacy is vital to our citizens' well being.

The last book, Teaching Machines: The History of Personalized Learning, reviewed by David Longman, fits in well with our theme. David warns the reader that the author, Audrey Watters indicates that the 'industrial age' of mechanised educational technology has not come to an end, as some might believe. Instead, it is thriving.

Conclusion

Because these research findings from earlier times can help us understand the power of ICT and its potential for supporting innovative approaches to schooling today, we are asking Naace members to send references to any research that they think may help to inform our university and school teachers today. Perhaps research that has had an impact on their work over the years.

In this context, together, Naace, MirandaNet, TPEA and MESHguides, all charitable foundations, are aiming to develop a repository that belongs to the profession and can provide a growing source of stimulus for new thinking that will remain in the possession of the members in perpetuity.

I will be commenting on what has been sent to us in the next Naace journal in the Spring as well as making the repository accessible.

Have a good Xmas. Naace has a stand at BETT22. See you there.

Professor Christina Preston

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References

Daly, C, Pachler N. and Pelletier, C. (2009) *Continuing professional development in ICT for teachers: A literature review. Becta Report One* here https://www.researchgate.net/publication/233981307_Continuing_Professional_Development_in_ICT_for_Teachers_A_Literature_Review

Daly, C., Pachler N., and Pelletier, C. (2009) *Continuing Professional Development in ICT for teachers. Becta Report Two* https://www.researchgate.net/publication/233981295_Continuing_professional_development_in_ICT_for_teachers_Report_2

Fullan, M (1993) *Probing the Depth of Education Reform*, Falmer Press, Taylor & Francis Inc.

Fullan, M (2002) *Leading in a Culture of Change*, Jossey Bass

Hudson, B., M. Leask and S. Younie (2021) *Education System Design: Foundations, Policy Options and Consequences*. Routledge

Leask, M and C. Preston, C. (2009) *E-tools for Future Teachers*: Becta, Coventry with Brunel University: download <https://mirandanet.ac.uk/wp-content/uploads/2019/09/ict-tools2009.pdf>

Manches, A., B. Phillips, C. Crook, I. Chowcat, M. Sharples (2010) *Shaping contexts to realise the potential of technologies to support learning from CAPITAL: Curriculum and Pedagogy in Technology Assisted Learning Project*. A Becta Harnessing Technology project undertaken jointly by the University of Nottingham and Sero Consulting Ltd. <https://dera.ioe.ac.uk/1672/>

Pachler, N, Preston, C., Cuthell, J.P., Allen, A. and Torres, P. (2011) *The ICT CPD Landscape in England* Becta download <https://dera.ioe.ac.uk/1769/>. This report contains a section about teachers who are reluctant to use learning technologies in classrooms that you can download here <https://mirandanet.ac.uk/wp-content/uploads/2019/06/Paper-reluctant-teachers-copy.pdf>

Preston, C (1994) *The Founding of MirandaNet* <https://mirandanet.ac.uk/the-founding-of-mirandanet-2/>

Preston, C. (2004). *Learning to use ICT in Classrooms: teachers' and trainers' perspectives: an evaluation of the English NOF ICT teacher training programme (1999-2003): summary, full evaluation report and emergent trends for teacher educators and staff-trainers*. London, funded by the Teacher Training Agency. Paper is here [MirandaNet Archive - Learning to use ICT in classrooms](#)

Venezky and Davis (2002a) *The Transformation of Schooling in a Networked World: Organisation for Economic Co-operation and Development (OECD)* <https://www.oecd.org/education/research/2073054.pdf>

Venezky, R. and C. Davis (2002b). *Quo Vademus: Where are we going? Organisation for Economic Co-operation and Development (OECD)* <https://www.oecd.org/education/research/2073054.pdf>

You will find many research publications that have been undertaken by MirandaNet Members here

<https://mirandanet.ac.uk/external-publications-by-mirandanet-members/>

Becta Reassembled

<https://mirandanet.ac.uk/becta-reassembled/>

Here, MirandaNet has reassembled over 300 research reports, project reports and advice documents that were published by Becta. These were undertaken by the professional community and they still have value both for current practice and to provide a starting point for future research and professional development programmes as well as an important archive of past work in educational technology. If you know of any Becta documents that are not listed, or entries that require corrections (e.g. many are undated) please write to: Professor Christina Preston christina.preston@naace.co.uk

Becta say IT in many languages

<https://mirandanet.ac.uk/say-it-in-many-languages/>

The Becta archive acquired by MirandaNet includes a number of lists that provide IT vocabulary in various languages. They are provided here as an easily accessed resource.

Use with caution if you are not a native speaker! These lists were produced in the 1990s and the most recent ones by about 2002. Just as the technology evolves, so too has the language used to describe its components and operations. For most non-English tongues the vocabulary has had to be invented or constructed and perhaps is more changeable because of that.

We welcome updates, corrections and commentaries on these vocabulary lists. Please email with suggested corrections.

christina.preston@naace.co.uk [Back to the Future in Education Innovation](#)

Back to the Future in Education Innovation

Looking forward from 2000

The Transformation of Schooling in a Networked World

Richard L. Venezky, Cassandra Davis

Paris OECD/CERI 2002

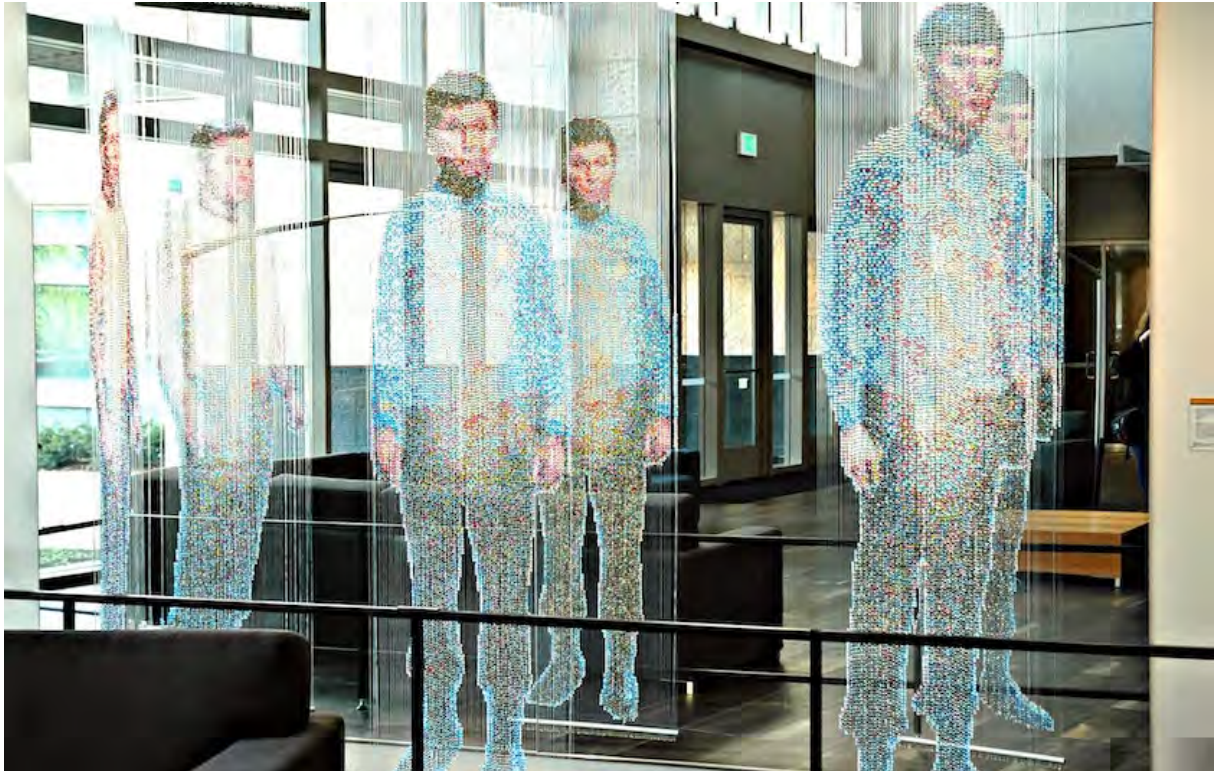


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The impermanence of innovations

The researchers agreed that Intranets, Internets, and other applications of ICT were powerful tools for school problem solving. But they asked, 'Does this guarantee that the infrastructures reported in the 94 case study reports in this study will still exist in 3-5 years? One of the major frustrations of modern schooling was the impermanence of innovations, they suggested. "What is here today may be here tomorrow but the likelihood of this occurring seems to depend on how compatible any new method is with what teachers traditionally do and believe, upon the context in which the change has occurred, and on the support system for the teachers'.

The researchers continue in this vein: "Rogers (1995) defines two basic reasons for the discontinuance of innovations: replacement with a more rewarding or effective innovation, and *disenchantment* because of a failure of an innovation to yield expected results. The literature on school change offers some interesting anecdotes, a plethora of case studies, but few trustworthy explanations for why innovations so often disappear with the speed of subatomic particles (e.g., Berman & McLaughlin, 1974; Fullan, 1999; Malouf & Schiller, 1995; McLaughlin, 1989). Computer designers and software developers, along with some educators, have been promising a technology-based revolution in teaching for at least 40 years but until the World Wide Web began growing exponentially, schools exhibited limited enthusiasm for any use of computers outside of word processing, spreadsheets, programming, and graphing and drawing. Even with

pockets of support over the past two decades for Logo, Pascal, BASIC, intelligent tutors, and computer games with an ostensible learning veneer, student-computer ratios until recently in most countries remained closer to 100:1 than to 10:1, thus blocking most attempts at integrating ICT into teaching. The exceptions were a small number of CAI systems, such as PLATO and TICCIT, that basked briefly in the sun prior to the microcomputer age and then rapidly disappeared from the classrooms (Venezky & Osin, 1991).

The World Wide Web, coupled with graphic interfaces and multimedia capabilities, has created a new potential, a new reality, and a new enthusiasm. But will it continue to spread within and across schools and will it survive the next national election, the next downturn in the economy, the next fad in instruction or in accountability? In most schools ICT has not become routine; even in the most successful cases reported here, pockets of teachers remain who have yet to accept a need for integrating ICT into their teaching or to be prepared to do this. Among those who have begun these tasks, further professional development is often needed. In addition, many infrastructures are inadequate for the applications desired, and budgets for expansion are not currently available.

How, then, will countries, regions, municipalities, and school districts maintain their current levels of ICT use and how will they complete the implementations under way? For many administrative units, in-depth reviews are needed of the current status of their ICT implementations, including their goals and the budgets, professional development, and other resources required to reach these goals. Then, plans need to be developed for hiring in-service staff-development, equipment purchase and maintenance, and the like. Schools that have regular cycles of goal setting, indicator monitoring, and review already are engaged in such planning with their higher administrative units. Central administrations can help through the adoption of policies and procedures that encourage or require ICT infrastructures and competencies. For example, in a few countries (e.g., Hungary), schools are already required to submit data on-line to the Ministry of Education.

Can ICT reach all schools?

The next question to ask about the future of ICT in schooling concerns the mechanisms for reaching all schools in a country. This is the problem of scaling up from a small set of schools to an entire region or state or country, a problem often mistakenly treated as an issue of how to transfer what works at one school to other schools. We see the problem quite differently and suggest that the term “transfer” is misleading in this context. Many of the schools reported here participated in demonstration projects where extra resources and support were made available. As mentioned earlier, some were (and continue to be) involved with university research projects that provided professional development, coaching, and teaching materials, thus making them impractical models for national or regional implementation. But more importantly, years of research on school change show that the implementation plans that work best for any school are a function of the attitudes and abilities of the staff, the quality of leadership, the role played by parents, the community and national context, and the resources available (Elmore, 2000; Fullan, 1999). Most of the plans reported here developed over many years and were adjusted continually to staff, student, administrative, and community changes.

Although several schools were funded to provide information to other schools on their ICT activities as a step toward the facilitation of transfer, we conclude from the entire set of case studies that transfer of one school’s plans to another is not a productive perspective to take on spreading ICT across a wider number of sites. Unlike the importation or transfer of a housing blueprint from one location to another, a major school improvement requires much more than just a level foundation to be built. Instead, scaling up should be viewed as creating the conditions at other sites that would encourage the development or adaptation of

successful ICT models. Successful implementation of ICT, however, is not simply a technical issue. It requires a vision about education and about the specific educational goals that ICT is to support. An ICT plan by itself is incomplete. As was stated in the first part of the Results section, policy makers should ask school administrators first for a strategic schooling plan and then for an ICT plan for supporting their school's educational goals.

The role of ICT in the future

Assuming systematic school planning, what ICT applications should we expect to see the coming years in schools? We speculate, based upon the most mature schools, that most applications of ICT beyond open tools will be managed through a virtual network where students have their own password-protected workspaces, keep portfolios of their work, submit homework and receive teacher feedback, and access course materials and general resources. Such systems will allow anywhere/anytime learning, and facilitate collaborative projects and communications with teachers, tutors, and peers. The interfaces for such virtual environments will probably change for different age or grade levels, building toward a style that is compatible with life-long learning sites by the end of secondary school. A few systems now in use such as Learning Space in The Netherlands (NLO4-Oost) are first steps toward this level of sophistication.

Many teachers will contribute to the content of these sites, either through their own lesson and resource designs or through selection of materials developed by others. By the middle of the elementary grades, students should acquire reasonable typing skills and use open tools for preparing reports, storing and analysing quantitative data, and presenting conclusions. By entry to the secondary level, students should prepare simple Web pages, use email for communications, and do guided searches on the Web. By the conclusion of secondary school, students should master the use of open tools, prepare complex Web pages, search intelligently for information, and access a wide variety of software learning programs and participate in virtual courses.

Professional development

To achieve the vision just presented will require teachers and administrators who are ICT and pedagogically savvy, yet just maintaining current (and often inadequate) levels of staff ICT competence is problematic for many schools. ICT use among teachers is not an irreversible process; leadership changes, staff turnover, and loss of technical support can negatively affect the diffusion process. At CA12- Crocodile Valley, staff turnover led to a drop from 75% of the teachers using ICT regularly to under 50%. A teacher at DE03- Albani reports that "If [the technical specialist] left, that would be a nightmare. Many things would come to an end." Staff turnover is a barrier to sustainability at a number of sites, including GR02-School B, where both the technical co-ordinator and the principal will be leaving over the next two years, and at HU02- Karinthy where 10% of the staff leaves each year. Yet many schools also report that ICT has become a way of life for their teachers and is unlikely to disappear. IL03-Neot David is typical of many schools in recounting how their teachers did not enter the world of ICT voluntarily but now that they are there they find ICT to be the normal way of life, providing a better professional future. Mastery of ICT skills and of teaching with ICT reduced their anxiety levels and made them more open to change and to innovation. Through pre-service and in-service education and through personal effort, teachers should become model citizens of the digital world.

Although professional development in ICT for teachers is being stressed world-wide, equal emphasis needs to be placed on administrative training for knowledge management, teamwork, community relations, and creating a culture of innovation and of mistakes--what in Germany is called "Fehlerkultur." Successful implementation of ICT in the classroom requires building-wide support that only a principal or headmaster

can create. Instructional innovation cannot occur in an environment that teachers perceive as punitive and unforgiving. Learning to use ICT for teaching, like learning to ski, rarely occurs without mistakes. Administrators who understand the culture of innovation can create environments that encourage experimentation.

Epilogue

How, then, to sum up? What flows from the spigot when we distil all 94 reports, five hypotheses and the accompanying summaries and recommendations? What are the lessons learned? What must be done to enjoy the full promise of ICT? One conclusion that emerges strongly is that technology is not a replacement for education nor is it a revolutionary force that requires traditional education to strip itself naked and be totally re-costumed. What we have learned over the last 100+ years about effective schooling, teacher practices, cognitive development, curriculum, and the like has not been rendered obsolete by the multi-gigabyte disk, the 1,000 megahertz processor, and the latest operating system. The filtering of information through the sense organs, the synaptic firings of the cerebral cortex, and the learning properties of the brain have not been changed by ICT. In fact, the attempt to integrate ICT into teaching has made the importance of a knowledge base on learning even greater.

Good education does not need to change to accommodate the particularities and power of technology. Instead, technology needs to change to accommodate good educational practices. Courseware needs to take into account what is difficult for teachers to teach rather than attempting to do everything that a teacher can do. Good teachers need resources that they can configure for different learning needs, not total packages that try to teach full courses. Teachers also need information for decision making, delivered when it is needed in a form that is manageable under classroom conditions. It is remarkable that engineers are capable of studying the perceptual, emotional, and cognitive demands on a jet fighter pilot under combat conditions and have adapted information systems accordingly, but yet are incapable of analysing, or unwilling to analyse the flow of competing demands in the classroom and render the same service to teachers. A classroom is a booming, buzzing confusion, with simultaneous voices, activities, and objectives. As on the battlefield and in the factory, technology could be adapted to control the flow of information, inform decisions, and track activities and outcomes. Such needs are primarily for new software that is designed for classrooms and teaching laboratories, rather than for banks, secretarial stations, and accounting offices.

Beyond this general need, there are stage directions for the actors at all levels of national educational systems. At the top level, ICT needs to assume its rightful place in national or regional budgets, curriculum, and examinations. If ICT skills are required for survival in the world of today and tomorrow, then they should be taught in the curriculum and tested at appropriate intervals. Teachers in many countries are currently receiving conflicting messages on ICT. National and local interests want ICT skills taught, but at the same time nothing is changed in the national curriculum and in the national examinations to accommodate these abilities. One exception is Luxembourg, where the progressive introduction of ICT use in learning and teaching will be explicitly mentioned in the mandatory curriculum and where ICT skills in mathematics will be part of the final examination for the school-leaving certificate for secondary schools within five years. In colleges, universities, and normal schools, pre-service education needs to adjust to the digital world. Graduates of the teacher education programmes should not only be comfortable with ICT applications but also should understand the importance of innovation and of change.

Today's technology probably will not be tomorrow's technology. Knowing how to use a specific search engine is not as important as understanding the problems in organising and retrieving information

from systems like the World Wide Web. The European Computer Driver's Licence may represent ICT competency for today but for tomorrow more advanced understanding will be required.

At the school level several changes are imminent. Intranets and Internets allow schools to create their own communities, drawing together people from around the world to enhance the learning, cultural identity, and occupational opportunities of their students. For schools to draw benefits from this community building ability, they need more flexibility in budgeting and in staffing. In Australia today, for example, some states allow schools to hire their own teachers. In many other countries (e.g., Italy) schools play a more limited role in their own staffing.

As stated several times in the Summary section, schools need to define how ICT is best used in instruction and provide teachers and classrooms with the equipment and technical support necessary to achieve these goals. If, for example, students are to work primarily in groups, with an emphasis on investigation of issues and presentation of results, then multiple display systems will be needed so that several groups can practice their presentations at the same time. If teachers are expected to create their own Web-based instructional materials, then software tools are needed to facilitate page composition, animation, graphing, and other functions. Besides including more effective teaching of ICT skills, the school curriculum should engage knowledge management, information literacy, and the reading skills needed for skimming and evaluating texts for relevance, accuracy, bias, and completeness. In-service staff development is also required, and judging from the reports received here, should focus on pedagogical issues, perhaps with group-based approaches and in class mentoring. Innovative instructional improvement approaches such as the lesson study plan (Stigler & Hiebert, 1999) might be helpful in developing ICT-based lessons.

As someone long ago quipped, "Prediction is difficult, especially of the future." What is not so difficult to predict is the continuing growth in the power of ICT and its potential for supporting innovative approaches to schooling. Whether we embark, like a Star Trek adventure, into new and uncharted realms of teaching and learning or circle again and again over the already explored terrain of traditional education is a function not of the power of ICT but of our creative imagination.

References

The citations in this detailed article can be found here:

<https://www.oecd.org/education/research/2073054.pdf>

Quo Vademus: Where are we going?

Venezky, R. and Davis, C. (2002)



Image Credit: : [Soham Banjerree](#) CC BY

Summary

The approach of this report was to examine ways in which technology presents opportunities to mediate learning interactions and then identify key contextual themes that shape the realisation of these opportunities. To this end, four examples were presented from the Capital research that each illustrated the opportunities which novel digital tools bring to support learning. These examples, whilst justifying optimism regarding the potential of new technologies, also highlighted various contextual factors that constrain this potential. Consequently, a framework was presented for categorising these factors. This framework was used to discuss key contextual factors emerging from the Capital research that highlight the challenges and opportunities for adopting and implementing technology to support learning. One important message to arise from the Capital work concerns differences between institutions in the extent to which certain technologies have been adopted to support learning. These differences highlight how progress should not be thought of as simply 'more of the same', but depends upon strategies for structuring the most appropriate context for adopting technologies.

During the Capital project, strategies for realising the potential of novel technologies emerged from the research and were presented in a final document at the end of Year 2 (Sharples et al, 2010). These findings, or recommendations, were organised around the five outcomes of the Harnessing Technology Strategy. In light of governmental policy changes since this earlier report, it was decided to structure this final report according to emergent themes rather than these outcomes; however, considering their role in shaping the research, the next section summarises how the themes discussed in this report relate to the five outcomes.

Harnessing Technology Strategy.

Harnessing Technology was first published by the Government in 2005 (DfES, 2005) and revised in 2008 (Becta, 2008). It set out a system-wide strategy for technology in education and skills. In this strategy, 5 outcomes were presented:

- Improved Personalised learning Experiences
- Confident system leadership and innovation
- Technology-confident, effective providers
- Engaged, empowered learners
- Enabling infrastructure and processes

How the Capital work discussed in this report maps to these outcomes is summarised below.

Improved Personalised learning Experiences

The Capital work took a learning focused approach. This is illustrated through the work to identify different learner interactions and how these were mediated by technology. Investigations also focused on the different forms of curriculum that might improve learner experiences, as well as how assessment might be transformed to benefit learners. Work has also focused on other forms of technology that might improve experiences, such as gaming for motivation or tools to engage higher order thinking.

Confident system leadership and innovation

A theme to emerge in the work was the important role of leadership in facilitating the adoption of technologies. This was reflected in the investigation of Leadership as a claim in Year 2 and was also a key theme to emerge from the innovation workshops, where leaders' attitudes to risk and their support of teaching staff emerged as central factors.

Technology-confident, effective providers

Another key theme to emerge in this work is the importance of teachers' attitudes and confidence with technology. Considering the importance of teachers' skills, the role of local authority CPD and peer training were investigated as claims in year 2. These highlighted the beneficial source of support that informal networks can provide. The research also examined the types of technology themselves, highlighting the challenge for providers to adapt informal tools into their context. Work was also carried out into how internet links between home and school could be developed to support learning, although findings showed how such bridging needs to take account of issues such as differences between home contexts.

Engaged, empowered learners

A theme running through the Capital work was how new forms of technology make learning more accessible and can support inclusion. A significant area of focus was the use of the internet and mobile technologies to support learning in out of school contexts, where findings suggested great potential. Another overarching theme has been e-safety, where a significant challenge for schools is ensuring a safe environment for learners, whilst not being averse to experimenting with novel tools for learning.

Enabling infrastructure and processes

A key factor affecting teachers' and leaders' attitude to adopting technologies was the reliability of the technologies being adopted. Taking this into account, strategies for investing in new technologies need to be coordinated with strategies for maintaining the reliability of the infrastructure. The action research reports in the Capital work were able to trace the challenges of such strategies over time, highlighting the need to consider the costs of maintaining equipment from the initial planning. The claim work focused on the role of

managed services and emphasised the value of greater involvement of ICT technical staff in school practice.

Recommendations

As emphasised throughout this report, the aim of Capital work was not to predict the trajectory of new technologies or even make suggestions for which technologies merit greater investment (e.g. Johnson, Levine & Smith, 2009). Instead, the work focused on identifying how to maximise the potential for technologies. Doing so required a good understanding of the contextual variables mediating this potential and strategies for addressing these. On these matters, the researchers present recommendations. Given the scope of Capital work, summarising the findings in this section was challenging and the reader was firstly directed toward work published during the last two years. A significant document was the Year 2 summary report where key findings were presented and mapped to the Harnessing Strategy Outcomes (Sharples et al, 2010). The purpose of the final section of this report is to summarise these recommendations using the framework developed within this report. Accordingly, the findings are summarised under the following four headings:

- Environment
- Learning content
- Agents
- Tools

Environment

Capital research has emphasised the opportunities for learning across settings. One clear message is that all sectors should explore new ways to remove boundaries between places of study, types of learner, abilities, and mode of learning. Schools can help achieve this through the efficient use of resources, by including open learning content in their teaching and by connecting classes through videoconferencing for instance.

Ways to support informal learning in home settings has been an important theme and further research should examine the wider benefits of home access to internet resources, such as enabling enquiry-led learning and project work in the home. Schools should also have guidance on how best to accommodate learner-owned devices, such as laptops and mobile phones, so that these are managed as devices for productive learning between home and school. However, there needs to be greater recognition that home can be a setting for tensions, with the family computer as the focus of conflict. Schools need support in making alternative provision for young people who are not able, or not willing, to learn online at home.

Children clearly bring to school many skills they have acquired in their home settings and schools should build upon this technical, media and collaboration experience and enthusiasm. The focus should be less on teaching about the technology and more on how to learn with new technology.

As well as considering the bridge between home and school, it is important to consider the school environment itself, where Capital work has emphasised the impact of different spaces. Therefore, physical learning spaces (classrooms, campuses) should be designed from the outset for flexible technology-equipped learning and with prior consideration of the various pedagogies that affords.

Learning Content

The Capital work has looked at the impact of the curriculum on pedagogy and the use of technology. This has involved research on alternative forms of new curricula being provided,

such as 'New Basics', and tentative evidence that more flexible curricula structures provide more opportunities to accommodate technology. One key challenge is to change the culture of assessment where

the requirements for summative assessment can unhelpfully drive practice. In this situation, there is a significant opportunity to develop assessment for learning, through diagnostic testing with rapid feedback, rich media assignments and feedback, and e-portfolios for self-reflection. There is also a need to support and assess learning over longer periods, through e-portfolios and activity logs.

New tools can support the assessment of new forms of curricula and new software is therefore needed to help in the assessment of 'rich tasks' that mix text, images, sound and video. Clearly, it is not just the technology, but how it is adapted and delivered within practice. One finding from the research considers how higher-order thinking can be developed through more project work both inside and beyond the classroom. More attention should be given to how technology can support this, with students working together to construct shared understandings and representations of complex problems.

Agents

One theme to emerge in the research is the perceived risk of introducing new technologies. Therefore schools, particularly school leaders, need encouragement to adopt radical solutions. An example of such a solution might be encouraging the use of learner-owned and personally managed devices to improve personalised learning experiences while reducing the cost of providing large numbers of desktop computers in schools.

Our research indicates that strong leadership from the top can facilitate change by creating a culture of openness and trust. Head teachers, College Principals and others with responsibility for CPD strategies should give space for teachers to experiment, while managing the risks. Giving teachers this space should help develop confidence, which needs to be further developed by building teacher skills. Teacher professional development should identify the skills and needs of each individual. Support may then be offered through a mix of formal training and personal learning communities (PLCs), with progress evaluated through self-reflection, peer critique and a portfolio of recorded achievements. Our investigation also found strong support for peer-to-peer learning as an expanding force in professional development. This should form part of a blended approach in which more informal, socially networked learning is merged with formal training. It is also important to consider the role of other agents within the educational setting. Technical staff, for example, have crucial roles not only in supporting change, but also in demonstrating new possibilities and providing critiques of narrow assumptions about technology.

Tools

The Capital work has looked at how different technologies that are currently available support learning interactions. E-assessment for example has been discussed as a means to transform learners' experience. Another technology that offers exciting potential is mobile technologies where we have found good evidence that they can enhance learning on visits and field trips, by connecting teacher-managed activities in the classroom with student-led explorations in museums. This can provide resources for further exploration and sharing back at school, but schools do need guidance on how to design and manage technology-enhanced field trips and visits.

The Capital work has also examined the potential of other developments, some of which have not been described in this current report. Cloud computing, for example, may bring efficiencies in all sectors, based on a combination of specialist education services, industry provision, open source applications, and open content – but only if concerns over data security and access control can be addressed. Capital has also investigated and found evidence for the successful student personal learning communities in large IT companies and in the 'study groups' of the Open University. This model of extended peer-supported

learning also matches the 'rich task' pedagogy, opening the possibility of supporting both workforce development and student learning through a similar set of technologies and processes.

A key theme to emerge with respect to tools is the opportunity for schools to adapt some of the growing number of resources which become available outside of the educational sector. Indeed, all sectors need to find effective ways to blend institutional services (such as VLEs) with products, often commercial, such as Web 2.0 and media sharing sites. Clearly, safety is a key issue and there needs to be a national debate on how institutions can support learners to engage in creative social learning through Web 2.0 technologies, helping them to develop appropriate strategies while protecting them from undue harm.

Final Summary

The findings described above present some key recommendations from the Capital research. The most significant contribution, however, is intended to be the language and framework developed in this report that provides a tool to help reflect and act upon practice. This report has provided a structure to identify the full diversity of interactions that make up 'learning' and hence an aid to consider how different forms of technology might be adopted to support such interactions. The potential of any technology, however, will depend on a range of contextual variables, and this report has attempted to map the most significant of these. Understanding how these factors play their role in individual institutions is key to maximising the benefits of adopting new technologies.

Capital work emphasises the old adage that it is 'not what you've got, but how you use it'. There is now greater recognition of the need to develop a more systemic approach, especially at the level of individual institutions, towards the combined progression of technology and pedagogy. The challenge is to promote and learn from these systems of success, in a period of diminishing public resources. Efficiencies will not come directly from the introduction of technology into education, since any new technology requires additional effort and resources for adoption and support, but through imaginative and sustained combinations of technology, teaching, learning and assessment.

References

The citations in this detailed article can be found here

<https://www.oecd.org/education/research/2073054.pdf>

Looking backwards to see forwards

How Covid-19 shone a spotlight on the barriers to accessing a high quality education online.

Anne Marcus-Quinn



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There have been many surveys conducted online in the last few months which have looked at the impact of Covid-19 on second-level education. The research published by the ESRI highlights many of the challenges that students and teachers faced during the lockdown (Mohan et al, 2020). The emergency physical closures of schools and severe disruption to education throughout the pandemic forced stakeholders to source digital resources online. At the start of the pandemic, as part of the emergency measures, many private companies made high quality digital resources available, at no charge, to students and teachers.

In Ireland, in March 2020 a group of publishers and the Irish Writers Union agreed to waive licence fees for selected books online. In France, with the support of the government, the Education Ministry's National Centre for Distance Education (CNED) stepped into this space. In the UK the government provided some £4 million in funding to Oak National Academy to provide online materials to teachers and those trying to home school children. These types of initiatives did not serve those without physical devices to use the resources and broadband was to be a big issue for others, but these moves were a hugely positive step for education at a crisis point.

However, we should not have been at a crisis point. We already knew about the digital divide, what is involved in the design and development of high quality digital teaching and learning material and the important role of properly curated educational repository services long before Covid-19 disrupted the world.

The Digital Divide

In the late 1990's there was a global awareness of an emerging "digital divide" and internationally there

was a flurry of activity by governments to try to address the problem through school-based interventions (Marcus-Quinn and Mc Garr, 2013). The physical school closures and the move to online classes forced governments to acknowledge the digital divide (Lai and Widmar, 2021; Azubuike et al, 2021). As we emerge from teaching through a pandemic, has anything really improved? Certainly, more schools now have a digital learning plan and many have also implemented a higher level of engagement with blended learning. In Ireland, and beyond, there is a rising number of schools requesting that incoming first years to post-primary also purchase a tablet or small laptop device so that, should there be further disruption to on-site education, at least the students will have a device to work with at home. Connectivity however, is outside the control of school communities. The lack of broadband continues to be a problem for many in Ireland.

High Quality Digital Materials

In order to comply with European legislation passed in 2019, public sector organisations and private companies and organisations need to check the accessibility of their websites, mobile apps, and media content. The publishing sector must also adhere to these common accessibility standards, ensuring that digital content can be used by all. However, similar to literature on the digital divide, those involved in instructional design have been advocating for high quality digital materials for many years; highlighting the need for digital materials to be formally designed and developed and acknowledging that this process requires professional time and resources (Wiley, 2002; Boyle, 2003; Bradley and Boyle, 2004; Geraghty and Marcus-Quinn, 2009).

Repository Services

Globally, the capacity and need for educational repository services has been proven time and time again. Between 2006 and 2012 in Ireland, in the context of third level education, we had a successful national repository in the National Digital Learning Resources (NDLR) service (Marcus-Quinn, 2013). This service was established as a collaborative pilot service project in 2004 largely by the University sector. By 2006, the NDLR had grown considerably as 21 of the Irish institutions of higher education became involved. By 2010, many members were registering from organisations outside the 21 main institutions of higher education in Ireland. These organisations included other educational institutions and bodies in the wider public sector. However, the repository service was shut down at the end of 2012. The majority of the digital resources were not accessible after this date, leaving the community without access to a service that they had helped to establish and grow. Other countries have had the same experience with national repositories for educational materials (e.g JORUM in the UK. The Registry of Open Access Repositories (<http://roar.eprints.org/>) provides some detail on repository services by country.

Conclusion

The impact of Covid-19 provides us with an opportunity to look at how these successes should be included in future school policy and investment in digital teaching and learning projects. We must not lose the momentum gained during the pandemic. There is a real opportunity to seriously commit to the UN sustainability goals regarding a quality education for all and we need to prepare now for as equitable a level of access to high quality digital content as is possible.

We cannot expect this to happen without cost. In the wake of Covid-19 there is a growing expectation from many that teachers should be designing and developing their own digital materials. We cannot expect teachers to take on the additional role of the design and development of high-quality digital content. We need targeted funding to populate a national repository that everyone can access. In 1999, Ireland did exactly this during the early stages of ScoilNet (Ireland's national repository for schools). We need resources that are quality assured and meet accessibility guidelines. Teachers should not be expected to

design and develop high quality digital teaching materials without adequate support.

References

- Azubuike, O. B., Adegboye, O., & Quadri, H. (2021). *Who gets to learn in a pandemic? Exploring the digital divide in remote learning during the COVID-19 pandemic in Nigeria*. *International Journal of Educational Research Open*, 2, 100022.
- Boyle, T. (2003). *Design principles for authoring dynamic, reusable learning objects*. *Australasian Journal of Educational Technology*, 19(1).
- Bradley, C., & Boyle, T. (2004). *The design, development, and use of multimedia learning objects*. *Journal of Educational Multimedia and Hypermedia*, 13(4), 371-389.
- Geraghty, B., & Marcus-Quinn, A. (2009). *An evaluation of independent learning of the Japanese hiragana system using an interactive CD*. *ReCALL*, 21(2), 227-240.
- Lai, J., & Widmar, N. O. (2021). *Revisiting the digital divide in the COVID-19 era*. *Applied Economic Perspectives and Policy*, 43(1), 458-464.
- Marcus-Quinn, A. (2013). *Digital Repositories and their Associated Services: From capacity building to sustainability*. In *Emerging Issues in Higher Education III: From Capacity Building to Sustainability*. EDIN. https://ulir.ul.ie/bitstream/handle/10344/4128/Quinn_2013_digital.pdf?sequence=2
- Marcus-Quinn, A., & Mc Garr, O. (2013). *Digital Divide in Post-Primary Schools*. *Internet research, theory, and practice: Perspectives from Ireland*. Research-publishing. net. https://ulir.ul.ie/bitstream/handle/10344/4338/Quinn_2013_digital.pdf?sequence=4
- Mohan, G., McCoy, S., Carroll, E., Mihut, G., Lyons, S., & Mac Domhnaill, C. (2020). *Learning for all? Second-level education in Ireland during COVID-19*. ESRI Survey and Statistical Report Series 92 June 2020.
- Wiley, D. (2002) *Learning objects need instructional design theory*, in: A. Rossett (Ed.) *The ASTD E-learning Handbook*, pp. 115–126 (New York, McGraw-Hill)

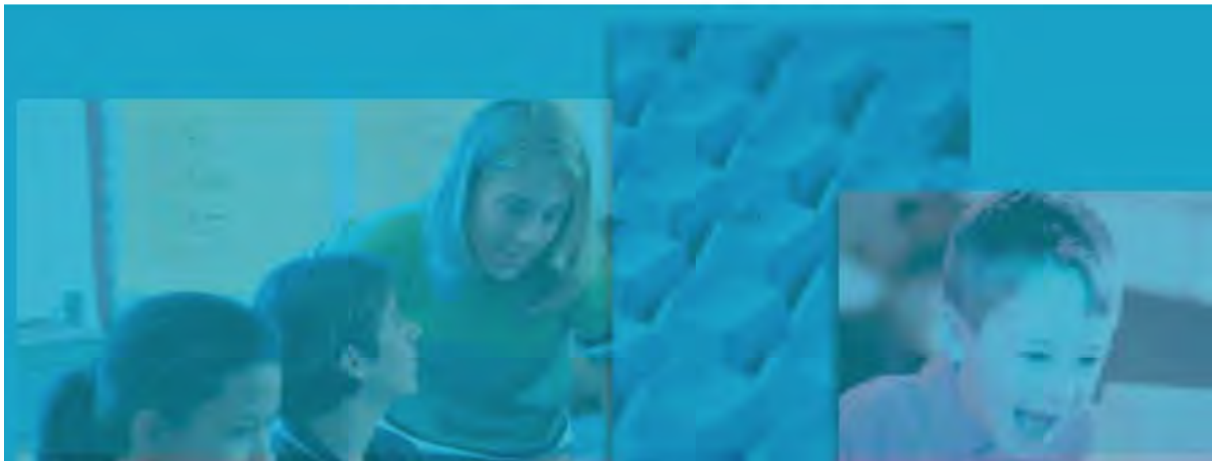
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ImpaCT2

Emerging Findings from the Evaluation of the Impact of Information and Communications Technologies on Pupil Attainment



Introduction

The ImpaCT2 project (Harrison et al., 2002) was a three-year investigation managed by Becta (the British Educational Communications and Technology Agency) into the impact of new technologies on pupil learning and attainment. Dr Vanessa Pittard (2011), former Director of Research at Becta, described ImpaCT2 as the ‘jewel in the crown’ of the final decade of Becta’s research.

The ImpaCT2 project was innovative in a number of ways:

- It developed and reported novel research methods to investigate pupil’s ICT activity in and out of school, and what was gained from such use (Somekh et al., 2002)
- It developed and applied new statistical methods for analysing the relationship between the effective implementation of ICT and standards of performance of pupils on national tests and GCSEs (Harrison et al., 2004).-
- It explored the nature of teaching and learning in and out of school, with a particular focus on teacher learning and development (Scrimshaw, 2001).

Pupils’ use of ICT in and out of school

Under the highly creative leadership of Bridget Somekh, the investigations into pupils’ uses of ICT included pupil logs of ICT activity, a questionnaire on Internet use, student-student collected recordings that were posted directly to the research team, covering such topics as when and in what ways computers were used at home and at school, and how sibling rivalries over access to the computer were managed. Not all schools participated in every part of the study, but overall, data was collected from over 2,000 pupils across 60 schools, and focused on three key stages: Key Stage 2 (years 5 and 6), Key Stage 3 (years 8 and 9) and Key

Stage 4 (years 10 and 11).

Important findings relating to students' use of ICT included the following:

- For most pupils the amount of time spent on ICT at home greatly exceeded the time spent on ICT at school. Pupils perceived that they had greater autonomy to explore ICT at home and the opportunity to use it for longer periods of time.
- Many pupils had sustained access to powerful ICT equipment and resources at home to support a wide variety of leisure pursuits. They were discriminating in use of the Internet, which enabled them to develop skills and literacies in networked ICT, confidence in its use, and a range of on-line social and communication skills.
- Home ownership of computers and home access to the Internet was increasing; however, at the time of carrying out the study, over a quarter of pupils did not have access to the Internet at home. Access to ICT (in public libraries, Internet cafés and on school premises outside lesson time) lacked flexibility and in some cases was expensive, so that pupils without access at home were disadvantaged.
- Pupils were aware of the moral and ethical debates surrounding the use of networked technologies and the perceived security risks. They were interested in discussing these issues and the majority used the Internet with discrimination as well as enjoyment.
- Pupils had an extensive awareness of the role of computers in their world. Awareness varied between individuals, but many were knowledgeable about a wide range of equipment and how it was used, as well as the varied purposes of its use by all kinds of people in many different locations. This had implications for the speed and ease with which they were likely to become skilled in using networked ICT: they developed skills in using networked ICT more quickly and easily than was often anticipated by schools and teachers.
- At all three key stages included in the study a significant and positive relationship was found between the levels of awareness held by pupils of computers in the world and whether they had home access to the Internet and their own personal email address.
- Pupils' perceptions of the nature of learning were shaped by their experience in school settings. They associated 'learning' with school-related use, and typically described all ICT use at home as 'games'. When the meaning of 'games' was probed, it was clear that much learning was taking place through their use of ICT for leisure pursuits, including learning of factual knowledge and conceptual understanding.

An analysis of the pupil logs and questionnaires also revealed some important data on ICT use at home and school:

- ICT use at home for primary school students averaged three hours per week; this was three times greater than the average of use reported at school.
- In the secondary school schools, average home ICT use was 10 hours per week, four times greater than the 2.5 hours per week reported for in-school use.

The relationship between use of ICT and attainment

In order to investigate the statistical relationship between the effective implementation of ICT and standards of performance on national tests and GCSEs, an ideal approach would be to have reliable data on three variables: (i) baseline data on each student's school achievement, on the basis of which one could make predictions of subsequent achievement, (ii) data on ICT resources and use in every school subject, and (iii) 'value-added' gain score data based on subsequent educational achievement (which would show the

difference between expected and actual performance, while reducing the effects of factors such as socio-economic status).

Thanks to the generous sharing of data from the University of Durham PIPs and YELLIS projects (Wiggins and Tymms, 2002), the ImpaCT2 team were able to achieve these goals. Working from reliable baseline data, we calculated average gain scores on National Tests at Key Stages 2 and 3, and GCSE results at Key Stage 4, and compared these with levels of ICT use in different subjects. ICT use was based on two sets of pupil questionnaires, administered half-way through and towards the end of the three-year project. Because we had data on all these variables for each individual student, we were able to compare the outcomes for individual students within each subject, comparing the gain scores of high ICT users with those of low ICT users, school by school, but also independently of whichever school they were in.

At Key Stage 2, in the period 1999-2002, the use of ICT across the curriculum to support learning was uneven, however a statistically significant positive association between ICT and National Tests for English was found at Key Stage 2. Positive associations were also found for mathematics at Key Stage 2, although they were not as striking and not statistically significant. It is possible, on the basis of these findings, to estimate that high ICT use at Key Stage 2 in English can help to raise performance by 3.12 National Test marks or 0.16 of a National Curriculum level, and in mathematics by 1.69 marks or 0.061 of a National Curriculum level. This is equivalent to a substantial acceleration in progress through these levels of 16% of two years' achievement in Key Stage 2 English, and 6.1% of two years' achievement in Key Stage 2 mathematics. The use of ICT to support the teaching of science at Key Stage 2 was low, with 76% of students reporting never or hardly ever using ICT in science lessons.

The research team revisited those schools in which there had been high ICT use associated with high gain scores, and asked the teachers how they used computers, and whether they felt the students' achievement was improved by such use. Teachers identified the following in relation to higher achievement in English:

Increased motivation and greater involvement in learning

- Higher quality outcomes encouraging greater commitment to writing tasks
- Relevant software making the learning of key skills (such as spelling) fun
- Increased time for reflection
- Use of ICT to support research skills
- Use of ICT to develop materials incorporating text and graphics

At Key Stage 3, by contrast, the majority of pupils (61%) reported never, or hardly ever, using ICT to support their learning of English. Science was the only subject where Key Stage 3 pupils reported a higher level of use than at Key Stage 2, with 31% using it at least some weeks in lessons in comparison with 24% at Key Stage 2. In English, maths and science, high ICT users outperformed, on average, low users of ICT. However, the only statistically significant positive association at Key Stage 3 was between ICT and the National Tests for science.

Teachers in schools where pupils used ICT in science and achieved higher mean gain scores identified the following key factors in relation to the use of ICT in science at Key Stage 3:

- Increased motivation and greater involvement in learning
- Higher quality outcomes encouraging greater commitment to writing tasks
- The use of simulations and modelling software to explore specific concepts
- The use of data-handling software for analysing, manipulating and presenting data

- The use of laptops to allow data logging in the science lab
- Use of ICT to support research skills

In the period studied in the ImpaCT2 project, the use of ICT to support learning at Key Stage 4 was relatively rare. The team looked at data on GCSE English, maths, science, history, geography, modern foreign languages (MFL), and Design and Technology (D&T). Seventy percent of students reported using ICT 'never' or 'hardly ever' in lessons, for all these subjects. However, there were some very interesting results associated with high ICT use in those schools that did bring ICT into learning. In all seven subject areas, the high ICT users outperformed the low ICT users. In three subjects, English, maths and history, the differences were not statistically significant, but those associated with science, geography, MFL and D&T were much greater.

That the most significant associations were found in science at Key Stage 4 may well be a reflection of the fact that science teachers in general had been developing materials and procedures longer than in other curriculum areas and had found ways of capitalising on the potential of the medium. Again, in science, there was a clear alignment between the content of the ICT and the content of the examination. The same was true of MFL and D&T. In the other subjects, and especially in English in the secondary school, there was no such correspondence between the content of the ICT used in English (which was often related to the presentation or publication of work) and the content of the examination. The editing skills that pupils were developing as they became more expert at presenting their work on the computer were not tested in Key Stage 3 National Tests, or at GCSE.

At Key Stage 4 in science, the difference in test performance between high and low ICT groups was the greatest of any of the gain scores in the ImpaCT2 project, and was equivalent to a score of 0.56 of a GCSE grade. Teachers identified the following key factors for teaching and learning using ICT in science at Key Stage 4:

- Use of the Internet for revision and research where topics require up-to-date information
- ICT providing instant feedback on strengths and weaknesses
- Use of simulations
- Resources located in subject departments

Conclusions

The principal outcome of this research was clear: ICT use was shown to be positively associated with improvement in subject-based learning in several areas. That contribution was statistically significant though not large. In none of the comparisons made between pupils' expected and actual scores in National Tests or GCSEs was there a statistically significant advantage to groups with lower ICT use. This is in contrast to the findings of some of the earlier related enquiries, most notably the several evaluations of Integrated Learning Systems published in the 1990s (including the first ImpaCT report: Watson, Cox, Johnson, 1993).

What was also clear was that the period during which this research took place was one of immense change in schools: the National Grid for Learning (NGfL) was being embedded, and the Internet was gaining traction in schools and homes. The report of the NCET Multimedia Portables for Teachers Project had only just been published (Phillips et al., 1999), and it was clear from this report that in 1999 the great majority of teachers did not own a computer, nor did they have access to the Internet at home. However, the report also showed that once teachers did own a computer, their confidence and awareness of potential use in school was greatly increased. As subsequent research has shown, wider teacher ownership of computers

and mobile phones, and more coordinated staff development, together with the support of the Regional Broadband Consortia and the NGfL was about to bring about a revolution in the relationship between technology and learning, in school and out of school.

References

Harrison, C., Comber, C., Fisher, T., Haw, K., Lewin, C., Lunzer, E., McFarlane, A., Mavers, D., Scrimshaw, P., Somekh, B. and Watling, R., 2002. *ImpaCT2: The impact of information and communication technologies on pupil learning and attainment*. British Educational Communications and Technology Agency (BECTA).

Harrison, C., Lunzer, E.A., Tymms, P., Fitz-Gibbon, C.T. and Restorick, J., 2004. *Use of ICT and its relationship with performance in examinations: a comparison of the ImpaCT2 project's research findings using pupil-level, school-level and multilevel modelling data*. *Journal of Computer Assisted Learning*, 20(5), pp.319-337.

Pittard, V. Plenary address, ITTE seminar on post-Becta research, University of Warwick, 4 July 2011.

Scrimshaw, P. (2001). *Teacher Development and the New Technologies: Creating Learning Communities*. In J. Price, D. Willis, N. Davis & J. Willis (Eds.), *Proceedings of SITE 2001--Society for Information Technology & Teacher Education International Conference* (pp. 3213-3218). Norfolk, VA: Association for the Advancement of Computing in Education (AACE).

Somekh, B., Lewin, C., Mavers, D., Fisher, T., Harrison, C., Haw, K., Lunzer, E., McFarlane, A. and Scrimshaw, P., 2002. *Impact2: Pupils' and teachers' perceptions of ICT in the home, school and community*.

Watson, D. M., Cox, M., & Johnson, D. C. (1993). *The Impact Report: an evaluation of the impact of information technology on children's achievements in primary and secondary schools*. Department for Education and King's College London, Centre for Educational Studies.

Wiggins, A., & Tymms, P. (2002). *Dysfunctional effects of league tables: a comparison between English and Scottish primary schools*. *Public money and management*, 22(1), 43-48.

Colin Harrison



Colin Harrison's research focuses on literacy and technology, and the intersection between them. From 2003-6 he chaired the International Reading Association's Literacy and Technology Committee. He was Principal Investigator on six research and evaluation projects for Becta between 2000 and 2010, including ImpaCT2, Web2.0 and Impact09. More recently his work has focused on critical Internet literacy, and the relationship between computational thinking and literacy development.

Digital tools and resources

CAPITAL: Curriculum and Pedagogy in Technology Assisted Learning



Image Credit: Bett 2005. : [EDSKJB](#) CC BY SA

Shaping contexts to realise the potential of technologies to support learning

A Becta Harnessing Technology project undertaken jointly by the University of Nottingham and Sero Consulting Ltd. that reported in 2010.

Manches, A., B. Phillips, C. Crook, I. Chowcat, M. Sharples

<https://dera.ioe.ac.uk/1672/>

Throughout this report the researchers emphasised that their aim had not been to predict the trajectory of new technologies or even make suggestions for which technologies merit greater investment. Instead, the work focused on identifying how to maximise the potential for technologies. Doing so required a good understanding of the contextual variables mediating this potential and strategies for addressing these. Their recommendations reproduced here are focused on this approach.

Given the scope of Capital work over three years, summarising the findings was challenging and the reader was firstly directed toward work published during the preceding two years. A significant document is the Year 2 summary report where key findings were presented and mapped to the Harnessing Strategy Outcomes (Sharples et al, 2010). The purpose of this final section was to summarise these recommendations using the framework developed within this report. Accordingly, the findings are summarised under the following four headings:

- Environment,
- Learning content
- Agents
- Tools

Recommendations

Environment

This Capital research emphasised the opportunities for learning across settings. One clear message was that all sectors should explore new ways to remove boundaries between places of study, types of learner, abilities, and mode of learning. Schools could help achieve this through the efficient use of resources, by including open learning content in their teaching and by connecting classes through videoconferencing for instance.

Ways to support informal learning in home settings had been an important theme and further research was planned to examine the wider benefits of home access to internet resources, such as enabling enquiry-led learning and project work in the home. It was suggested that schools should also have guidance on how best to accommodate learner-owned devices, such as laptops and mobile phones, so that these are managed as devices for productive learning between home and school. However, greater recognition was advised about the home being understood as a setting where tensions might arise with the family computer as the focus of conflict. Schools need support in making alternative provision for young people who are not able, or not willing, to learn online at home. Nevertheless, it was acknowledged that children clearly brought to school many skills they had acquired in their home settings and schools should build upon this technical, media and collaboration experience and enthusiasm. The focus should be less on teaching about the technology and more on how to learn with new technology.

As well as considering the bridge between home and school, it was important to consider the school environment itself, where Capital work has emphasised the impact of different spaces. Therefore, physical learning spaces (classrooms, campuses) should be designed from the outset for flexible technology-equipped learning and with prior consideration of the various pedagogies that affords.

Learning Content

The Capital work looked at the impact of the curriculum on pedagogy and the use of technology. This involved research on alternative forms of new curricula being provided, such as 'New Basics', and tentative evidence that more flexible curricula structures might provide more opportunities to accommodate technology. One key challenge was to change the culture of assessment where the requirements for summative assessment might unhelpfully drive practice. In this situation, there was a significant opportunity to develop assessment for learning, through diagnostic testing with rapid feedback, rich media assignments and feedback, and e-portfolios for self-reflection. There was also thought to be a need to support and assess learning over longer periods, through e-portfolios and activity logs.

New tools were suggested to support the assessment of new forms of curricula and new software was, therefore, needed to help in the assessment of 'rich tasks' that mix text, images, sound and video. Clearly, it was not just the technology, but how it is adapted and delivered within practice. One finding from the research considered how higher-order thinking could be developed through more project work both inside and beyond the classroom. More attention should be given, it was suggested, to how technology can support this, with students working together to construct shared understandings and representations of complex problems.

Agents

One theme to emerge in the research was the perceived risk of introducing new technologies. Therefore schools, particularly school leaders, needed encouragement to adopt radical solutions. An example of such a solution might be encouraging the use of learner-owned and personally managed devices to improve personalised learning experiences while reducing the cost of providing large numbers of desktop computers in schools.

The research indicated that strong leadership from the top could facilitate change by creating a culture of openness and trust. Head teachers, College principals and others with responsibility for Continuing Professional Development (CPD) strategies should give space for teachers to experiment, while managing the risks. Giving teachers this space should help develop confidence, which needs to be further developed by building teacher skills. Teacher professional development should identify the skills and needs of each individual. Support might then be offered through a mix of formal training and personal learning communities (PLCs), with progress evaluated through self-reflection, peer critique and a portfolio of recorded achievements. This investigation also found strong support for peer-to-peer learning as an expanding force in professional development. This should form part of a blended approach in which more informal, socially networked learning is merged with formal training.

It was also considered important to consider the role of other agents within the educational setting. Technical staff, for example, have crucial roles not only in supporting change, but also in demonstrating new possibilities and providing critiques of narrow assumptions about technology.

Tools

The Capital work looked at how different technologies that are currently available support learning interactions. E-assessment for example was discussed as a means to transform learners' experience. Another technology that offered exciting potential in 2010 was mobile technologies where the researchers found good evidence that they can enhance learning on visits and field trips, by connecting teacher-managed activities in the classroom with student-led explorations in museums. This can provide resources for further exploration and sharing back at school but schools needed guidance on how to design and manage technology-enhanced field trips and visits.

The Capital work also examined the potential of other developments, some of which have not been described in the current report. Cloud computing, for example, was thought to have the potential to bring efficiencies in all sectors, based on a combination of specialist education services, industry provision, open source applications, and open content – but only if concerns over data security and access control could be addressed. Capital also investigated and found evidence for the successful student personal learning communities in large IT companies and in the 'study groups' of the Open University. This model of extended peer-supported learning also matched the 'rich task' pedagogy, opening the possibility of supporting both workforce development and student learning through a similar set of technologies and processes.

A key theme to emerge with respect to tools was the opportunity for schools to adapt some of the growing number of resources which become available outside the educational sector. Indeed, all sectors need to find effective ways to blend institutional services (such as VLEs) with products, often commercial, such as Web 2.0 and media sharing sites. Clearly, safety was a key issue and there needed to be a national debate on how institutions might support learners to engage in creative social learning through Web 2.0 technologies, helping them to develop appropriate strategies while protecting them from undue harm.

Summary

The findings described above presented some key recommendations from the Capital research. The most significant contribution, however, was intended to be the language and framework developed in this report that provided a tool to help reflect and act upon practice. This report provided a structure to identify the full diversity of interactions that make up 'learning' and hence an aid to consider how different forms of technology might be adopted to support such interactions. The potential of any technology, however, will depend on a range of contextual variables, and this report has attempted to map the most significant of these. Understanding how these factors play their role in individual institutions is key to maximising the benefits of adopting new technologies.

Capital work emphasises the old adage that it is 'not what you've got, but how you use it'. There is now greater recognition of the need to develop a more systemic approach, especially at the level of individual institutions, towards the combined progression of technology and pedagogy. The challenge is to promote and learn from these systems of success, in a period of diminishing public resources. Efficiencies will not come directly from the introduction of technology into education, since any new technology requires additional effort and resources for adoption and support, but through imaginative and sustained combinations of technology, teaching, learning and assessment.

Mike Sharples



Mike Sharples (Biography: Mike Sharples) Mike Sharples is Emeritus Professor of Educational Technology in the Institute of Educational Technology at The Open University, UK and Honorary Visiting Professor at the Centre for Innovation in Higher Education, Anglia Ruskin University. His research involves human-centred design of new technologies and environments for learning

He inaugurated the mLearn conference series and was Founding President of the International Association for Mobile Learning. As Academic Lead for the FutureLearn company, he informed the design of its social learning approach. He is Academic Lead for the nQuire project with the BBC to develop a new platform for inquiry-led learning at scale. He founded the Innovating Pedagogy report series and is author of over 300 papers in the areas of educational technology, learning sciences, science education, human-centred design of personal technologies, artificial intelligence and cognitive science. His recent book is *Practical Pedagogy: 40 New Ways to Teach and Learn*, published by Routledge.

E-tools for Future Teachers:

Marilyn Leask and Christina Preston

Becta with Brunel University

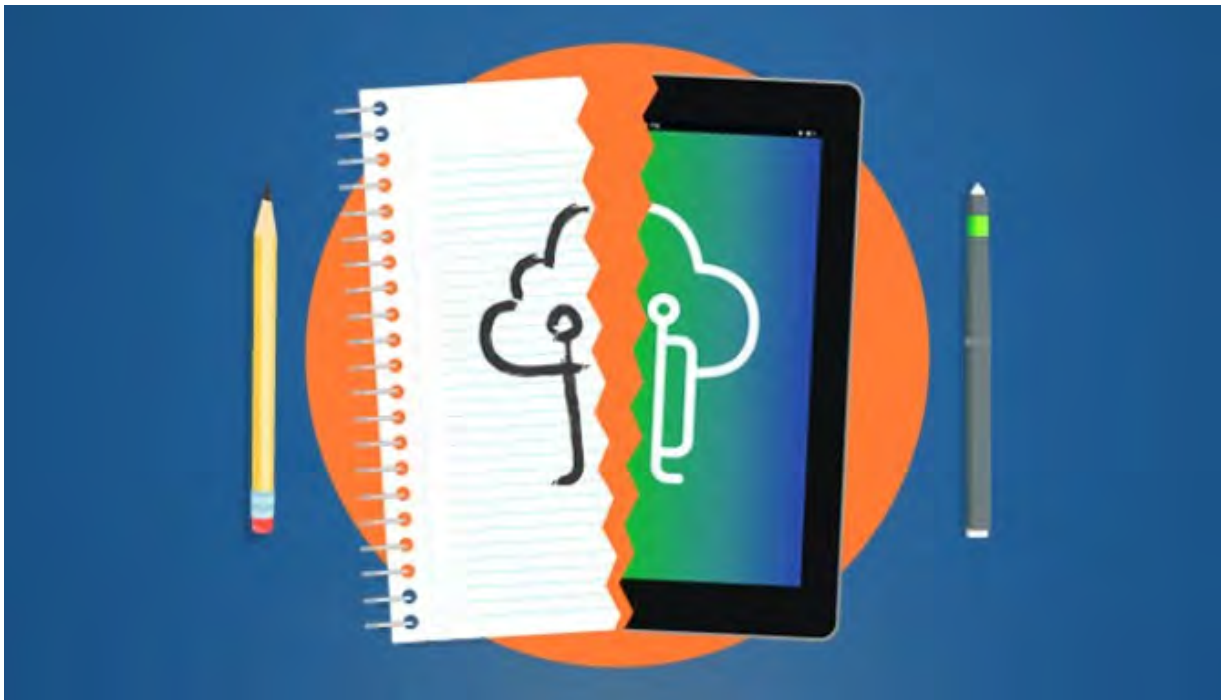


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Another one of the series of Becta Harnessing Technology reports

The purpose

The purpose of this report was to provide Becta with research-based advice to support effective ICT use by teachers now and in the future. The research underpinning this report was focused on five questions:

What in the views of practitioners, are the characteristics of effective technology-based tools and resources and how do they help teachers do their work well?

What are the characteristics of effective non-technology based tools and resources and how do they help teachers do their work well?

Where do practitioners go to find out about and access new tools for learning and teaching? What are the key challenges faced by practitioners in doing their job well?

Which ICT tools would help in the future? What digital solutions would be needed? If these solutions do not exist, could they be created? What would their characteristics be, and how and when would they be used?

This detail was intended to be particularly relevant to government agencies making decisions about the deployment of resources to support change, teachers and school managers wishing to transform practice in their schools, local authority and university staff responsible for the training of teachers and to software developers for whom there was quite specific advice about the design of educational software appropriate for 21st Century classrooms.

Main findings and recommendations

The Becta Harnessing Technology Strategy (2008) expressed the expectation that schools would make use of the pedagogical benefits of ICT tools. This research found that there was, indeed, a widespread awareness of ICT tools as used in everyday life and understanding that ICT could enable teachers to do their jobs well, as well as improve the functioning of the institution.

However, the major barriers to improving the use of ICT tools and resources in school were:

knowledge about the ways various technologies can be used to enhance teaching, learning and assessment is very patchy with deep knowledge scattered across the education system and therefore hard to access, and;

concerns about the huge variation in the quality and reliability of the technical infrastructure which teachers had to rely on to integrate ICT tools into daily practice.

The recommendations which followed identified barriers to effective use of ICT tools, together with actions which could improve the knowledge base in the education system. Five major recommendations emerged from the findings that were suggested, which were considered to be within the specific remit of Becta as a national lead organization. Firstly teachers identified a number of characteristics of effective technology-based tools which Becta might draw to the attention of developers. The reason is that ICT tools did not seem to be tested fully with users and it was proposed that an industry standard for user testing be established. In addition, marketing information should include information about the pedagogical approaches supported by the tools. Tools in their content, design and technical aspects should support deep learning and not be based just on an information transmission model.

The time taken for the adoption of tools for which there is a clear benefit can be very short. However, the lack of detailed examples and evidence of pedagogical impact and application was inhibiting adoption of ICT tools. The researchers thought that it was likely that this material existed but had not found its way to the individual teachers to whom it was relevant. Any such exemplars needed to be convincing for school leaders and teachers who were not early adopters of ICT tools. Unless information of this type targeted at particular curriculum applications was readily available and promoted, change in the use of ICT tools from the current position was thought to be slow.

Another point was that the number of free tools for schools was increasing in 2009. In addition, purchasing models were changing from stand alone packages to annual subscriptions with regular updates downloadable in the school. The researchers warned that industry would need to demonstrate extra added value of the tools they were charging for: interoperability, adaptability and pedagogical application were the key characteristics of effective tools.

Recommendation 1: Curriculum

That new working practices should be developed between software developers, teachers, and researchers to:

- ensure software for the education market is founded explicitly on a full range of effective teaching and learning approaches 2 not just drill and practice
- exploit the potential of ICT tools and resources to support creative pupil-led learning
- develop industry standard models for user testing of software (design and pedagogical applications) so that on release the tools are accompanied by sound information about pedagogical application and potential impact

- establish standards for the pedagogical labelling of ICT products
- publish exemplar case studies showing how products can be fully used to enhance learning.

Recommendation 2: Assessment Practices

Statutory curriculum and assessment requirements were seen by the researchers as ‘the elephant in the room’ in discussions about embedding ICT tools in practice and ICT tools for the future. The development of personalised learning pedagogy and the embedding of ICT tools in practice were hindered by the assessment system. The suggestions were that to support changes in practice, examples were needed of effective practice with respect to multi-modal assessments and just in time assessment including online, and the use of e-portfolios.

Becta were encouraged to work with leading schools, examination boards and relevant government agencies to:

- develop and disseminate future practice in assessment which recognises e- portfolios and multi-modal assessments
- develop forms of assessment, taken when the pupil is ready, recognizing the benefits of this approach for inclusion and personalized learning. In addition, identifying realistic practice for teachers of large classes in some subject areas, in managing individual pupil progression. For example, aspects of pedagogy teachers may consider when using ICT tools include forms of learning supported, links with particular curricula, grouping and timing issues, appropriate forms of assessment for learning.

Recommendation 3: Developing organisational and individual capacity

Decisions about the adoption of major ICT tools such as learning platforms were taken at the local authority or Senior Management Team (SMT) level. (Most of the local authority control has disappeared now that Academy chains do this job). The extent of SMT engagement with staff in the decision making and the level of SMT understanding of the pedagogical benefits of the technology both had a significant effect on the adoption and embedding of the innovation. Becta, the National College of School Leadership (NCSL) and other education partners also had an ongoing role in ensuring SMTs understood the pedagogical applications of the technologies being adopted and were aware of effective ways of engaging staff in the change process. In addition, teachers spent considerable effort collecting and inputting assessment data, for which it appeared little use was made.

The researchers observed that adoption of new ways of working with ICT Tools takes time – time to play, time to test ideas, time to embed change. It is recommended that there be widespread sustained provision of CPD designed to maximise impact.

The researchers commented that their quick search on Google showed just how prevalent the expectation was that professionals would undertake CPD to a certain level of points annually, as a condition of continuance of professional registration. As a result, Becta, the National College of School Leadership and other relevant bodies were advised to work together to brief school senior management teams (SMTs) about:

- the pedagogical benefits of ICT
- the need to avoid expensive mistakes by involving internal and external
- experts in senior management decisions about whole school ICT tools and
- strategies
- the effective use of assessment data to help learning and in change

- management strategies within the organization

A key observation was that in order to ensure that when new ICT tools are proposed for schools like learning platforms, the forms of CPD should provide focus on pedagogical application of the tools and these should be spread over a period of time to allow for introduction to the tools, testing in the teacher's context and follow up. Suggestions for groups of developers were that it might be effective to combine efforts to subsidise CPD in their ICT tools across LA/HEI school networks. Online networking could be used to support knowledge exchange about effective practice and such forms of CPD and online collaboration could be recognized within the proposed 'licence to teach' CPD points scheme. Another idea was to provide case studies of effective use of learning platforms across all sectors, as there appeared to be a significant lack of understanding about how to use the learning platform to support the whole work of the school.

In addition, developers might provide remedial support and interventions for schools where the lack of reliability of the learning platform and/or lack of understanding of how to use the learning platform has damaged staff confidence in this way of working.

Recommendation 4: National infrastructure to support knowledge sharing

Primary, secondary and FE subject specialists reported isolation from peers in other institutions and requested online networking support to enable knowledge sharing and collaboration between themselves, examination boards and university staff. This was such a strong theme to emerge from the focus groups that time was taken to review current provision and practice. Examples of online networking for professional groups, from other countries and other sectors in the UK, were examined for relevance. Teachers saw clear benefits for the education sector in provision of a 'Facebook' type environment for education, linking people in public or private networks, listing events, providing a 'project finder' tool and linked with 'back streaming' tools. Current learning platforms used in school and regions did not provide this form of networking and functionality did not allow easy connection with experts across the UK. Networks such as Becta's ICTRN did not seem to have mechanisms for the summarising and accumulation of knowledge, so that similar questions may be asked over and over. Regional and LA learning platforms were providing some connectivity between professionals which is valued but there did not seem to be many interconnections between LAs and regions. The education sector in the UK is behind other UK sectors in access to online communities workspaces constructed to meet professional needs.

Currently it was observed that opportunities were being lost for cross-national collaborations on current major initiatives, such as the ICT Training for Teachers and the Masters for Teaching and Learning, as well as other CPD work e.g. that was commissioned by the Teacher Development Agency and undertaken by teachers. Generally, cheap and cheerful approaches using 'free' online tools, whilst providing some experimental opportunities, were causing frustration because of: hidden costs; the lack of interoperability; lack of functionality; limitations on customisation; lack of access through firewalls; concern over embedded advertising; ownership and access to information and so on. The teachers expressed very strong views that national Web 2 infrastructure was needed, as was provided for other sectors.

An argument was put forward for the provision of online environments to support knowledge sharing between educators, who were innovators and early adopters, and industry who are developers. The networks that were current in 2009 such as the Becta forums did not support this form of collaboration. The recommendations below were offered in this context.

Becta should work with other relevant bodies to develop a national infrastructure to support knowledge sharing across the sector, which would include:

- a list of educational networks and expertise in the sector being brought together, promoted and maintained to facilitate teachers' ability to find colleagues with similar interests and the expertise needed to develop practice.
- a learning platform open to all teachers with tools to support knowledge sharing.

Teachers were aware of the functionality of Facebook type software and this infrastructure was wanted universally by respondents, regardless of sector or quality of provision in the school and local authority. Current 'free tools' did not meet the need for a national infrastructure. However, the researchers believed that to promote professional openness, such an environment would need to be managed by professional organisations rather than a central government organisation. As schools, local authorities and HEIs did not have the remit to provide a national service, promoting exchange of innovative practice nationally, a lead in this area had to come from an organization with a national remit.

Recommendation 5: Change management strategies used by Becta

The researchers found that it was critical that Becta adopted change management strategies which were proven to be effective in bringing about whole sector change. The data suggested that when major new technologies were introduced, the speed of adoption would accelerate if time was taken to test out and develop pedagogical applications with innovators and early adopters, before roll-out across the sector. A clear relationship with assessment would also accelerate the motivation to change.

Adopting this model would mean that new ICT tools, such as learning platforms, would not be introduced to all schools until case studies and exemplars outlining the pedagogic justification for use – for different age groups, subjects and contexts- together with CPD, were available.

It was also suggested that Becta should review the model used for introducing ICT developments across the education system, to ensure any changes and innovations proposed were always accompanied by exemplars of practical application drawing on effective practice in leading schools.

Reference

Leask, M and C. Preston, C. (2009) E-tools for Future Teachers: Becta, Coventry with Brunel University: download here.
<https://mirandanet.ac.uk/wp-content/uploads/2019/09/ict-tools2009.pdf>

Marilyn Leask



Marilyn Leask is Professor of Education at De Montfort University having previously been Professor of Educational Knowledge Management at the University of Bedfordshire and a Professor at Brunel University. She is a trustee of the Education Futures Collaboration Charity[2] and the Bedford and Milton Keynes Waterway Trust. Leask specialises in the knowledge required for teaching, knowledge management in education and in building the evidence and knowledge base for teacher education. Classroom practice has developed from her research on digital technologies and teacher knowledge and how digital technologies can be harnessed to support lifelong learning for teachers. Leask co-chairs the Mapping Educational Specialist knowHow, Knowledge mobilisation and Translational research initiative in education.

Professional Development

ICT CPD Landscape

The context for developing Continuing Professional Development programmes in ICT for teachers.

Daly, C., Pachler N., and Pelletier, C.

Led by UCL, Institute of Education, University of London.



Image Credit: Wikimedia , CC BY SA

The second Becta report, independently published in 2011.

Executive summary

This report presented the findings from a qualitative study of Continuing Professional Development (CPD) in Information and Communications Technology (ICT) for school teachers in Key Stages 1–4 in England. The research aimed to identify ‘effective’ CPD, by collecting accounts from teachers, senior leaders and CPD providers, in which they described the key features of ICT CPD which made a difference to teachers’ use of technologies in their practice, based on their experiences. The research questions were:

- What models are there for ICT CPD?
- What are the key factors in ensuring that ICT CPD affects pedagogy and practice?

1.2 Models for ICT CPD

The researchers found that in this decade, 2000 to 2010, models for ICT CPD were highly individual and varied. In the vast majority of cases, the headteacher was the key player in shaping ICT CPD, according to what kind of ‘vision’ they had of technologies and of teacher development generally within their school. They had the main role as gatekeeper to different forms of provision within the school, and determined access to other forms of provision outside the school, or involvement of external agencies. Outside agencies (Local

Authorities (LAs), City Learning Centres (CLCs) and commercial companies, for example) could determine models available to teachers outside the school environment, but their effectiveness was greatly affected by the ways in which the school supported the strategies being advocated. Views of what can be gained by schools from 'outsiders' were deeply divided and the involvement of external expertise was a main distinction between types of provision.

The research found that the dominant model across both primary and secondary schools was school-based and 'in-house' CPD. There was minimal involvement of Higher Education, other schools or freelance providers in ICT CPD. LA provision was more prevalent, though this varied greatly between schools within the same Authorities. Commercial companies were drawn on mostly to provide one-off skills training sessions to accompany the purchase of new software (such as interactive whiteboards (IWBs)) and were rarely involved in pedagogical development. Nearly all participants reported a shift away from course-attendance as a main CPD experience.

Schools provided in-house CPD in the following ways:

- Compulsory formal 'Inset' sessions for all staff about using new technologies
- Compulsory small group sessions for staff who share subject or phase backgrounds, frequently based on developing pedagogy
- Optional after-school CPD sessions on specific software
- Brief 'tasters' or briefings at staff meetings to provide updates on new software

Providers of in-house CPD were mostly school-based, according to the teachers and headteachers who were interviewed as part of the study. Although some use was made of external providers, the vast majority of ICT CPD experienced by teachers was reported as being provided by colleagues within their own school. There was a belief among most headteachers that outsiders would not provide the most appropriate CPD for their school and that, financially, it was not a priority to spend on external expertise or for staff to attend external courses. There was fairly widespread resistance to covering lessons to allow teachers to attend CPD during the school day, when it was perceived that they could be fully trained in after-school sessions.

Models involving external providers are extremely varied, because they often develop bespoke CPD or adapt generic approaches according to:

- a commercial interest in selling/supporting their particular software
- the results of audits carried out by various parties (the school, the LA, the company) which indicate dominant skills needs among staff
- school-generated requests for particular training in response to policy initiatives such as the adoption of learning platforms
- a provider remit to develop subject-focused pedagogy
- a provider commitment to professional development by supportive networks

The other main feature which distinguished models of provision is how far the CPD was based on collaborative, bottom-up, teacher-generated activities involving several contributors, in contrast with centralised, one-size-fits-all, whole-staff CPD usually provided by a single 'expert'. Primary school teachers were far more likely to experience collaborative approaches to ICT CPD as part of the school CPD strategy. In both primary and secondary schools, teachers and senior leaders reported 'unofficial', informal, self-initiated meetings with colleagues after school or in non-contact time as particularly effective for developing

ICT practice, but this did not always feature officially as CPD and was often undertaken in teachers' own time.

Models of provision by external bodies were highly varied. In some cases, providers delivered whole school or departmental sessions based on skills training. Other providers worked closely with individual teachers or groups of teachers to develop planning and worked in classrooms, demonstrating teaching approaches, team teaching and supporting the class teacher in trying out new pedagogy. Most providers tried to build in opportunities to make return visits to schools to ensure that some form of follow-up activity was taking place, to help the teachers to embed the new technology in their classes.

Key features to ensure ICT CPD is effective

Many of the features of effective ICT CPD could be attributed to teachers learning from each other within schools which had a strong sense of community and a shared ethos of learning among the staff. In particular, there were non-hierarchical divisions between 'experts' and 'non-experts' with ICT, and high value was placed on the sharing of expertise between staff within 'mixed ability' groups. The most important feature was that teachers who had more experience were given opportunities to share with those who had less. Informal conversations were vital, as was dedicated time to allow teachers to talk together and plan for new approaches in terms of their use of ICT in learning and teaching.

Although talking with colleagues in school was extremely important, there was a tendency for schools to become 'inward-looking' where there were limited opportunities to see how technologies were used in other schools. It was important, therefore, to recognise the need for 'outward-looking' aspects of successful ICT CPD. The judicious use of external and internal expertise was an important factor in introducing teachers to new ways of working, including in schools which appeared to have successful in-house approaches to CPD. The involvement of external expertise needed to be carefully managed by senior leaders, however, so that it complemented individual as well as school needs and was not just used to satisfy apparent 'gaps' in provision.

The following features were factors which ensured CPD positively affected practice:

- **Leadership:** this was considered a prime factor by school staff and external providers. A clear 'vision' for ICT CPD was vital to the success of any approach, and could help manage problems caused by lack of time or lack of funds. Effective leaders made the best use of the expertise of their staff, not just in terms of their ICT skills, but also in terms of setting up collaborative peer learning which made the most of excellent practitioners and good communicators.
- **Time:** this was also mentioned by almost all participants. Teachers resented time spent on ineffective CPD, but there was a positive response to time given to work with colleagues to plan and review classroom strategies which were immediately practical and could be implemented straight away.
- **Informal learning:** this was a very important aspect of working in a school as an effective learning community. Although informal learning was not something that could be planned as such, it was facilitated by inclusive leadership styles, democratic staff relationships and lively staffroom talk.
- **A sense of community:** this was a feature of effective school-based ICT CPD and included the whole school workforce in collaborative approaches to developing practice by frequent talk about classrooms and opportunities to network with colleagues.
- **Clear links between CPD and practice:** CPD activities have to be immediately applicable to the classroom and ICT has to have a clear purpose in enhancing learning. At best, CPD takes place in classroom contexts, with colleagues and external experts working together to try new approaches.

The following forms of CPD were found to positively affect practice:

Learning with colleagues in small groups: for staff with positive accounts of ICT CPD experiences, there had been a trend away from whole-school Inset sessions towards group work as a valid form of CPD activity. Groupings differed according to skill levels, subject or software interests, and were frequently the main vehicle for discussing practice and planning new approaches.

Working with newly qualified and trainee teachers: this was a consistent theme in teachers' and senior leaders' accounts of professional development opportunities. The contribution of new teachers to the ICT professional development of established staff should not be underestimated. They can inform and inspire the work and practice of other staff as a result of their understanding of the potential of ICT to support teaching and learning.

Observation: opportunities to observe colleagues teaching using ICT brought clear benefits, but was very rarely experienced as part of planned CPD for most teachers, except in one LA where it is part of a CPD strategy involving observing external experts who visit classrooms to teach.

CPD within classrooms with pupils: there was a lot of positive experience of opportunities to work with external experts using ICT within classrooms.

Subject specialist CPD: this was a very strong need among secondary teachers, and was met by access to subject associations and LA specialists, but was not well developed within schools.

Ownership of equipment: the need for ownership of equipment to facilitate 'playing with kit' was a consistent factor in developing confidence, mentioned by both senior leaders and teachers.

Working with teaching assistants (TAs) and learning support assistants (LSAs) to develop ICT practice: was a frequent positive and helpful experience mentioned by senior leaders, but far less by teachers.

Issues that inhibit effective ICT CPD

Teachers frequently noted that a lack of intellectual challenge was a demotivating factor in experiencing ICT CPD. They were critical of 'just practising' skills where this did not link with deeper consideration about pedagogy. They were highly sceptical of what they perceived as the rhetorical over-selling of technologies, and reported occasions where representatives of the Building Schools for the Future (add note) initiative had argued that face-to-face learning in classrooms is outmoded. Teachers had deep commitment to making personal relationships and cultivating effective communication with young people in real classrooms, and wished to use technologies to support these values.

It was considered to be important that CPD was used to encourage innovation and excellence as well as addressing a deficit among teachers' use of ICT. Several teachers commented on ICT CPD being unchallenging and aimed at raising all teachers to a common basic standard, rather than developing their expertise as individuals. This was also reported by commercial providers, in their accounts of what they were asked to do when providing ICT CPD. There appeared to be a tension between addressing individual and whole-school development needs. Teachers reported that the latter usually dominate the CPD agenda. The subject needs of teachers were also frequently not a priority in secondary school provision, and in-house expertise could be lacking here, according to teachers' experiences.

Lack of adequate access to technology was reported to have a seriously detrimental effect on teachers being able to take ownership of how to work with technologies and develop confidence by embedding them routinely in everyday practice. Despite reports of schools being well equipped centrally, the persistent pattern was of teachers lacking easy access to flexible ICT in their own teaching classroom. Lack of access

for non-ICT teachers to physical space where computers were based in specialised suites was a major factor which restricted the everyday adoption of practice involving technologies. This was compounded by lack of ownership of equipment that was additional to centrally stored kit, so that teachers could not experiment at home, for example, by having more laptops with appropriate software.

A very strong message that emerged from headteachers was that funding for ICT CPD should be ring-fenced. ICT CPD was not perceived as a priority among competing agendas for school improvement, and was not associated by some head teachers with raising attainment levels in literacy and numeracy, which currently dominated CPD plans in many primary schools. The use of funds was also problematic, however. There was a tendency in some schools for ICT CPD to be heavily linked with buying in particular products from commercial providers rather than learning how to use a range of software. The free-market context which currently linked a lot of CPD to purchasing policy for particular technologies was not necessarily beneficial for pedagogical development.

The conclusion here was that the ICT CPD landscape was subject to many powerful influences, including commercial interests, the demand to showcase high-profile technologies and the competing CPD agendas driven by high stakes testing which can inhibit pedagogical development. Despite all this, there were clear messages about the features of effective CPD and what it takes to develop them.

Norbert Pachler



Norbert Pachler is Professor of Education at the UCL Institute of Education. As Pro-Vice- Provost: Digital Education at UCL, Norbert makes an active contribution across all aspects of the Office of the Vice-Provost Education and Student Affairs on UCL-wide initiatives, with a particular focus on academic oversight of digital education across the university

ICT CPD Landscape in England: which programmes were developed?

Pachler, N, Preston, C., Cuthell, J.P., Allen, A. and Torres, P.

The third Becta funded report on ICT CPD, independently published in 2011. Led by UCL, Institute of Education, University of London.

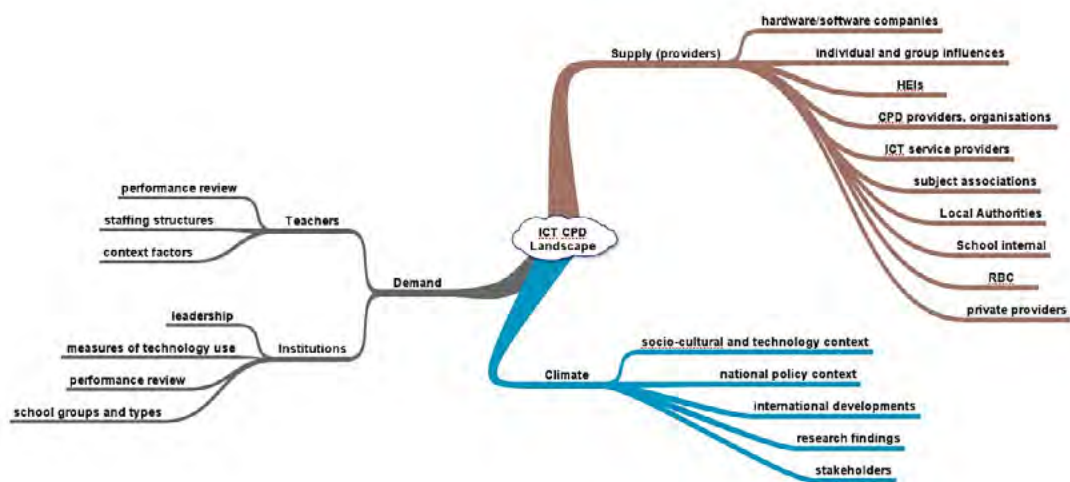


Becta X Project. Image Credit: [Ian Usher](#), CC BY NC SA

Executive summary

Following on from the report about context and models for ICT CPD, this Landscape study reports on Information and Communications Technology (ICT) Continuing Professional Development (CPD) programmes that were actually available to teachers across England in 2009/2010. Data collection took place in the Autumn of 2009. Although the project findings are based on some desk-based research, the findings are mainly derived from primary data collection through traditional interviews, questionnaires and focus groups.

One outcome of the project, derived on the basis of an experimental methodology, a remotely authored digital domain map, loosely represents the prevailing ICT CPD Landscape. This mapping method was used to ascertain the value of mapping to conceptualise complex domains such as ICT CPD. The map was intended to capture and aggregate perceptions of the landscape held by representatives of the following groups: researchers and providers of, experts and teachers in and leaders receiving ICT CPD. As such the map is invariably subjective.



The map has three branches: Climate focusing on socio-cultural and technological as well as policy factors at local, national and international levels that impact on ICT CPD Provision; Supply plotting providers; and Demand mapping stakeholders, influential groups of professionals, both formally and informally constituted. It has to be noted, though, that these subdomains are increasingly overlapping.

On the Demand side, this study investigated the opinions of 60 practitioners, 20% of whom were reluctant to use digital technologies in classrooms. 40 informants were ICT CPD leaders in schools. 30 providers were chosen to represent all the key categories identified in the domain map on the Supply side.

In terms of methodology, the project used largely qualitative data collection methods: 90 questionnaire responses were supplemented with in-depth individual and some focus group interviews. Given the small sample size of 130, the findings need to be treated with caution and should be viewed as emerging trends.

The findings are discussed in relation to five categories: providers, leaders, practitioners, field forces and some general observations about the market.

Providers felt they were limited in their provision by market conditions. As a result they were rarely in a position to lead schools into new areas or challenge school priorities. The market is also small and uncertain because schools do not have ring-fenced funds for CPD in general and ICT CPD in particular. A wide disparity was noted between an individual teacher's technical skills and competence among those who attended training.

The main means of advertising courses was via fliers, emails to schools, course brochures, and newsletters. Very few Providers used online advertising or social networking sites, although they noted that a number of teachers found out about their courses via word of mouth.

28% of respondents reflected on the need for changed leadership priorities at school and government level, also mentioning the loss of ICT advisers as a critical factor in the lack of ICT CPD now taking place. School management or agendas were the most frequently mentioned drivers of ICT CPD. This was followed by government and Local Authority policies; 23% of the sample of provider training focused on software without apparent reference to learning outcomes or teacher confidence. Most providers referred to the

necessity of accommodating school needs, even if the provider identified other strategies.

The type, number of courses and number of participants varied across the group. LAs were most consistent offering half to full days, series of sessions and in-school CPD. Some Providers had a group maximum – this occurred mainly within commercial respondents while others took whoever attended. Course content was overwhelmingly about skills and ICT in classrooms, i.e. on the curriculum application of the technology rather than pedagogy. Apart from university provision, there are limited opportunities to consider wider issues such as pedagogy or change management.

There was consensus that supply cover and funding had become major factors impacting on teachers being able to attend courses, their ability to learn or to find uninterrupted time to develop what they had learnt. Many providers saw the future for CPD in blended learning, i.e. online, self-directed and face-to-face models.

Most providers had a Mission statement or Vision that they linked to the evaluation of course objectives. However, the overall quality and breadth of provision could seemingly have been improved if more robust evaluation were undertaken, focusing particularly on relevance to classroom practice and change management. Techniques such as evaluation by outcomes were also seemingly in need of strengthening.

The providers identified two new directions for ICT CPD: a change from skills training to strategies around the embedding of ICT and an increase in influence of face-to-face conferences, educational blogs and micro-blogging such as Twitter.

The majority of **leaders** found out about CPD opportunities via their LA or through their own initiative, primarily searching online or through professional networking. Leaders tended to promote CPD opportunities via informal colleague networks or by passing information to certain staff members who they felt would benefit. The selection of CPD programmes for staff appeared to be based on an assessment of needs, although it was not always clear what form this needs analysis should take. The cost and time required for training as well as the location were frequently given as factors in deciding which CPD to undertake. They were also cited as barriers preventing ICT CPD from being undertaken. Leaders also suggested the refusal of some senior management to see the benefits of ICT CPD as a barrier.

Leaders described a significant move towards in-house ICT CPD provision, provision through communities of practice and learning informally using Web 2.0 applications. The majority of ICT CPD leaders consider themselves to have high levels of skill in the application of digital technologies. A few leaders of ICT CPD in schools suggested that they are not receiving enough CPD at a high enough intellectual level to deal with the dangers and demands that digital technologies can present. These few leaders also wanted provision that focuses on the innovative pedagogical opportunities that digital technologies offer, the management of change and media issues. Some leaders also thought that some senior management teams might do more to tackle the issues that make teachers reluctant to use ICT in classrooms.

Practitioners complained about the lack of entitlement to CPD in general and seemingly a number of in-house CPD leaders appeared to be ignoring the desire of some practitioners to pursue formal qualifications through external courses as a career enhancement move. More practitioners than leaders expressed a keenness to learn and to belong to communities of practice in order to fulfil this learning desire. Linked with this interest in informal learning, practitioners stated that the most effective CPD they had attended varied enormously. Several cited the face-to-face and online meeting through professional communities and micro-blogging as being good forms of CPD.

Some practitioners felt that issues about the use of digital technologies in classrooms were not being

addressed by providers or leaders ranging from reliability problems to concerns about e-safety, unreliable equipment and web services, poor support services, ethical and moral concerns, poor pedagogical practices and fears about social isolation, lowering achievement and celebrating limited achievements too highly. Many of the teachers who were reluctant to use digital technologies in classrooms said they would welcome more professional debate at a higher intellectual level about the role of digital technologies in education and more evidence about their effectiveness, as well as discussions about good practice.

External factors impacting ICT CPD delivery.

Five factors were identified on the basis of the study of background literature and baseline data; these were validated by the primary data gathered:

- the availability of external courses to meet individual and institutional needs
- staff expertise within institutions to provide in-house CPD
- robust ICT infrastructure and support
- the length and timing of ICT CPD offerings
- leadership and vision

A number of additional factors were identified that had not emerged strongly from the baseline data, but were mentioned by the participants who were most active in seeking out opportunities for their own learning:

- professional e-communities of practice
- informal CPD networks run by teachers' professional organisations
- personal learning networks, maintained through services such as Twitter and the Blogosphere

In addition some factors that were identified as constraints were policy and funding driven. These were:

- dedicated time for CPD: teacher tiredness in twilight sessions was cited by providers, leaders and practitioners
- the lack of a national framework for CPD
- no compulsion for schools to provide appropriate CPD
- funding issues
- CPD being driven by perceived current needs, rather than long-term strategy

Overall the findings raised questions about how the CPD in ICT Landscape might be defined beyond 2010. The patterns emerging suggested a far more decentralised, informal and fragmented picture than had been the case in the past. The varied offering by providers and the diverse background and training of the trainers made it difficult to evaluate the impact of existing programmes. Limited rigour in evaluation of provision increased the challenge of identifying relevant and challenging course content and effective ICT CPD models.

There existed a concentration of effort into programmes about skills and curriculum applications. Harder to find were courses that link classroom applications to pedagogy, underpinning theories of learning, ICT management and the management of change. The mismatch between supply and demand appeared partly to be caused by the lack of availability and funding for high-level training for providers and leaders and a lack of understanding at senior management level about how digital technologies best be deployed through school development plans in terms of pedagogy and management infrastructure.

Some groups of school practitioners did not have the support of their schools to pursue their own

professional development because of the time and cost involved. Others complained that existing ICT CPD programmes did not meet all their needs. A few early adopters amongst these professionals elected to join national and international communities of practice to improve their informal learning opportunities - largely online.

In this context, the most significant insights appear to be around the growing 'self- help' agenda. As leaders and practitioners became more self-reliant, more schools had begun to manage their ICT CPD agendas in-house which points to even more fragmentation of the factors and field forces in this area in the future.

The trend towards fragmentation of the ICT CPD landscape shows no slowing down. On the contrary, there appears to be a growth in informal learning opportunities organised and directed by practitioners themselves. These fledgling grassroots developments can, perhaps, be harnessed to enrich more formal ICT CPD provision.

Recommendations

Entitlement to professional learning

Entitlement to professional learning in general should be a priority for practitioners and leaders. In the ICT field, it was felt courses should include coverage of e- assessment and evaluation as well as covering matters such as classroom application, subject pedagogy, underpinning theories of learning, ICT management and the management of change. Importance was attached, in addition, to entitlement to professional learning about educational issues such as e-safety and filtering for technical staff and network managers.

Most providers, leaders and practitioners asked for national policy and guidance that identifies protected, dedicated time for teachers, leaders, senior managers to attend, participate in and/or develop continuing professional development in the field of ICT. Consideration might also be given to funding personal CPD budgets for teachers separate from the school's CPD budget. Support for informal communities of practice might be one cost-effective way to increase the amount, relevance and immediacy of ICT CPD that can be offered online in a professional context significantly.

Some requested national CPD framework prompts that would emphasize the value of informal personal learning networks as a means of learning and recognise that online events should be accommodated and recognised within a new framework.

Evaluation and assessment of professional development and learning

The evidence collected suggests that the evaluation of CPD programmes needed to be improved including the incorporation of methods that measure impact on achievement over time. Providers should be encouraged to undertake robust evaluation of their provision, focusing particularly on relevance to, and impact on classroom practice and change management. More thought should be given to the potential role of digital technologies in assessment, including making use of the multimodal and collaborative affordances of digital technologies.

Senior management issues

Concerns about the lack of value accorded to ICT CPD by some senior managers might be addressed by provision of leadership courses that cover questions of theory, ethics, pedagogy, the integration of ICT in learning processes and change management, as well as issues associated with running a network. Senior managers, it seemed, also needed to ensure the reliability of equipment in school in order to enable staff to be more comfortable using ICT in classrooms.

Support for schools

In order to extend and develop ICT CPD input through groups such as ASTs and SiPs, relevant case studies should be developed that exemplify good practice. ASTs and similar groups might be offered relevant CPD opportunities that develop their potential as multipliers.

Provision for an overarching national online community of practice

Social learning online over a sustained period of time appeared to be an effective way of learning about how to use ICT for teaching and learning. Therefore, the development of an overarching national online community of practice providing a one-stop shop for access to informal and formal CPD and expert providers might be a useful way of harnessing increasingly fragmented individual endeavours.

Improving ICT CPD Provision

Based mainly on the data gathered from providers the following recommendations could be made:

- That policy and guidance identifies protected, dedicated time for teachers to attend, participate in and develop continuing professional development.
- That funding supports dedicated time for teacher CPD. Consideration could be given to funding for teachers' personal budgets discrete from a school's CPD budget.
- That providers undertake robust evaluation of their provision, focusing particularly on relevance to classroom practice and change management and, where possible, that they follow up evaluation of outcomes.
- That more courses go beyond acquiring technical skills and focus on pedagogical practice as well and that they also include strategic and pedagogical considerations. Provision of courses with relevance to management should also be safeguarded.

Qualitative research methodologies

The use of digital concept maps was found to provide an effective means of collaborative conceptualising of a complex domain across a distributed group of experts and other informants. Researchers were recommended to consider the use of concept mapping for the collection of perceptual data.

Alison Allen



Allison Allen is Director of Outstream Consulting and has held a number of education leadership and governance roles in complex multi-stakeholder environments. Currently she is chair of governors for a multi-academy trust (leading on safeguarding, curriculum, standards, and special educational needs); she is a past Trustee of Naace, London Grid for Learning, a Senior Fellow of MirandaNet and a Founder Member of the Chartered College of Teachers.

Allison has a proven track record at senior level within the education sector, as an author and specialist in school leadership development, using education technology to enhance the life chances of children, supporting the moral imperative to develop learners who have the higher thinking skills and confidence that sustains effective, safe, innovative use and creation of technology.

John Cuthell



John Cuthell ran Virtual Learning, a consultancy specialising in research, evaluation and change management aspects of e-learning. Part of his work involved research into the training and development needs of industry and education.

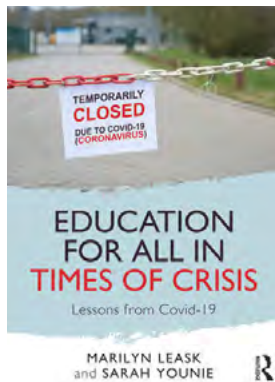
For a number of years John was the Research and Implementation Director for the MirandaNet Academy, developing practice based research accreditation for teachers. International MirandaNet action research projects evaluated the global impact of interactive whiteboards on teaching and learning and the role of CPD in professional development.

John worked in education for a number of years, and researched and evaluated the impact of new communications technologies on teaching, learning and working. With a background in Language, Communication Studies and Cognitive Psychology, his main focus was the extension of a long-term PhD research project on the impact of ICT on thinking, learning and working, published as 'Virtual Learning' (2001, Ashgate, Aldershot).

Book reviews

Ensuring Schooling for All in Times of Crisis: Lessons from Covid-19

Marilyn Leask and Sarah Younie



The fact that a volume of this magnitude could be produced within this timeframe, during a global pandemic, in and of itself qualifies the editors and contributors of this book as leading scholars on the futures of education.

During a time when phrases such as #buildbackbetter and #qualityeducation are often used with little regard for definitional substance, this book brings much-needed theoretical depth within a crisis.

The book is simultaneously pragmatic and deeply rooted in conceptual substance. It provides futurecasting and planning toolkits. It focuses on 'lessons learned'. It engages the most critical debates of our time during a period of intense uncertainty in education.

This scholarly curiosity is amplified in the research-based approach that forms the bedrock of the book. A series of global webinars since the early months of the first year of the global pandemic informed the thematic structure of the book and provided richly contextualised, solution-seeking insights. The global participation in the project provides a unique foundation for all the contributions within this book. To be able to tap into the wisdom and shared experiences of participants from more than 30 countries in the world, truly constitutes a unique intellectual endeavour. The book also forefronts the tribulations of marginalisation in education and, perhaps, creates a pathway in which marginalisation, in all its forms, may be prevented in the future.

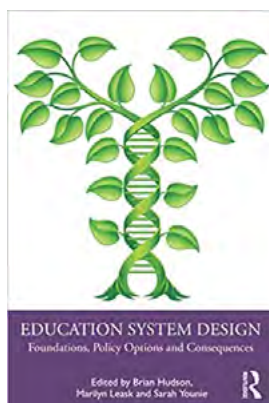
The book champions educational continuity and suggests innovative ways in which it may be ensured in the future. Yet, within the innovative suggestions proposed, sound education principles still prevail. The book leaves one with a sense of possibility, even as we traverse one of the most profoundly challenging eras in education history.

Reviewed by:

Professor Irma Eloff, Dept of Educational Psychology and former Dean of Education (University of Pretoria)

System Design: Foundations, Policy Options and Consequences

(Hudson, Leask and Younie, 2021) Routledge



This book comes at a critical time when the values that underpin our and its institutions, including schools, are under growing threats from the forces of globalisation. It recognises the urgent need to reconceptualise education, including the role of citizenship

education, in ways that provide young people the knowledge, skills and values not only to promote democracy but to protect and defend it. It also draws attention to the crucial role that the education system plays in such a reconceptualisation. Only a truly

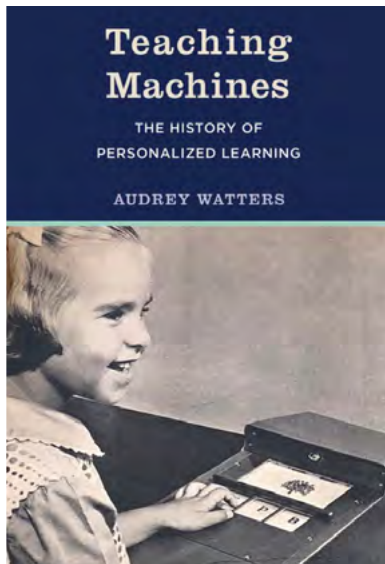
national education service can guarantee that all young people are educated to be knowledgeable, responsible and reflective active citizens that are, and will be

willing to tackle with confidence the challenges of learning, working and living in 21st century societies. We ignore such a reconceptualisation at our peril.

Reviewed by David Kerr Consultant Director of Education, Young Citizens & Head of ITT, University of Reading

Teaching Machines: The History of Personalized Learning

Audrey Watters, MIT Press, August 2021



An important theme to emerge from reading 'Teaching Machines' by Audrey Watters ([MIT Press, 2021](#)) is that the 'industrial age' of mechanised educational technology has not come to an end, as some might believe. Instead, it is thriving.

In her introduction Watters summarises, among others, the argument of Sal Khan (the creator of [Khan Academy](#)) that for the first time [my italics] online learning enables a truly personalised approach to learning in or out of school. At last, online learning enables us to break free from the stifling effects of an outmoded education based on regimented, bureaucratic organizations that fail to enable effective learning. It is, however, a too familiar critique of education that has served its time as a rationale for disruptive innovation in education, one often taken up by those proponents of learning technology who argue that schooling is somehow broken.

As Watters argues and aims to demonstrate in this book, the 'end of history' story on which Khan bases his claims is wrong. She goes further. Not only is he wrong about the unchanging face of schooling but he denies history. It reflects a general 'Silicon Valley' inspired ideology that the past is irrelevant and that only the future matters. In this way, old ideas can be recast as unprecedented, innovative and disruptive to a moribund educational system:

“What today’s technology-oriented education reformers claim is a new idea - ‘personalised learning’ - that was unattainable if not unimaginable until recent advances in computing and data analysis has actually been the goal of technology-oriented education reformers for almost a century.” (p9)

Teaching Machines is a well-researched and largely well written illustration of this history, providing critical commentary on the notion that machines can be so designed as to afford effective learning with minimal intervention from teachers. It also illustrates that implementing machine-based learning at scale has long been a challenging ambition (again an issue not always acknowledged by contemporary disruptors). Although her focus is American education the story is relevant to the design and implementation of technology in similar school systems.

The scope of the book is confined to key figures and projects in the quest to develop mechanical tools for school learning and teaching covering the years from about 1920 to 1970. The technology under discussion is literally boxes containing gears, rolls of paper or similar media, occasionally electric lights (and in an early version even a dispenser offering chocolate bars), all controlled by simple levers and keys for user input. Although now superseded, many of the main features of these pre-digital devices remain familiar today in much educational software:

to present a 'unit' of content, usually offering a question or task;

- to provide a means for a learner to respond;
- to provide feedback on the response (ideally immediate);
- to move to a new 'unit', or repeat the current one, based on that feedback.

A central figure running through this story is B.F. Skinner, not so much the originator of Behaviourist psychology (its origins trace back to the early 1900s), as its post-war bête-noire doggedly promoting his mechanical teaching machine as a device to change the manner and quality of school-based learning. The story of Skinner's machines covers a surprisingly short period from about 1949 to about 1969, with antecedents in the 1930s. However, by the end of this period there was limited tangible effect on education beyond a few successful if not entirely rigorous trials.

Although today mechanical teaching machines tend to be known as 'Skinner machines', he was not the inventor of the concept. First World War recruitment revealed low levels of health and education in the population. Then, as now, education was perceived to be poorly managed with overworked and ineffective teachers. At war's end a new emphasis was placed on testing for attributes such as intelligence or retention of learning. A key figure here was Sidney Pressey and his 'automatic teaching machine' that first appeared in 1923. Pressey foresaw an "industrial revolution" in an education system he regarded as stuck at the "crude handicraft stage". However, like Skinner after the Second World War, he experienced frustration with efforts to develop his device as a commercial enterprise (though he was unfortunate to be doing this in the midst of the Great Depression).

Skinner's own early work at Harvard in the 1930s focused on developing the idea of behavioural conditioning using devices he made known famously as "Skinner boxes". With these he trained pigeons to get food when the correct lever was pressed. His insight that these techniques might be applied to school learning came in 1953 when he visited his daughter's fourth grade class (the top-end of UK Key Stage 3). As Skinner told the story he was shocked to see that the classroom teaching of basic arithmetic failed to meet what he regarded as the minimum conditions for learning, namely progression matched to ability (i.e. 'stimuli' in behaviourist terms) and timely feedback (for the pigeons an edible reward). Good students were held back, he observed, while those who needed help could not keep up. "The teacher", he declared, "is out of date" and cannot provide adequate and timely feedback (i.e. reinforcement) to many children at once. Echoing Pressey (who he met and corresponded with during these post-war years), Skinner also declared that an "industrial revolution in education" is needed.

Interestingly, even as Skinner promoted his approach to Behaviourism as the true science of learning a paradigm shift was already beginning to take place that would challenge this viewpoint. Cognitive Science began its emergence as the new science of psychology and human learning (an early conference was organised by Jerome Bruner in 1959) and the term 'Artificial Intelligence' as a framework for understanding human thinking was adopted by a community of scientists and engineers at the now notorious [Dartmouth College conference](#) in 1965.

There is much in this book to interest students of the history and origins of contemporary education technology as well as commentators on the current scene. In 1958 Sputnik stunned American national pride in its cultural and scientific prowess leading to many reforms. In education a new focus was brought to the teaching and learning of critical subjects as mathematics and science. While this gave a boost to the idea of teaching machines many problems about their design and usefulness remained to be solved. Content was a major issue and the field of Programmed Instruction (PI) grew in importance as more work was done to enhance the quality of both what was 'taught' by machine and how it was taught through sequence and structure.

It is a familiar story to contemporary readers that efforts to verify the value of this new technology through large-scale school-based investigations were largely ineffective or that by contrast projects by publishers to produce cheaper textbooks designed on PI principles (what today we might call branching texts) were relatively successful. Like Pressey before him Skinner had chronic difficulties in persuading his manufacturing partners to produce machines to a quality benchmark that satisfied him. Even so, it was hard to compete because his machines still lacked content. He later entered into partnerships with encyclopedia publishers because their established door-to-door sales model helped to forge a strong link with the idea of home-based learning and 'free' teaching machines were offered with every encyclopedia sale.

However, these efforts did little to enlarge the market or make teaching machines more acceptable to educators. In schools, the familiar issues of staff training, machine reliability and the scarcity of curriculum content dogged the enterprise. Moreover, by the turn of the decade in 1960-70 new ideas about pedagogy were emerging. This included a backlash against Behaviourism and increased dissatisfaction with post-war efforts to reform the teaching of mathematics and science. But Watters argues that teaching machines did not simply die out; they were absorbed:

“... many of the key figures in the teaching machine movement did not suddenly stop working in teaching or training when the focus turned to computer-based education. Many of the ideas that propelled programmed instruction persisted and spread into new practices and new technologies.” (249)

Here she makes a case for the idea that behaviourism and its core concept of conditioning did not disappear from the mainstream of educational technology, as its most articulate critics might argue, but continues to inform the design aims of present-day educational technology. Indeed, it is fundamental to the massively successful “industrial” character of our new digital technology culture for it too relies on sophisticated techniques of “behavioural engineering” to actively nudge (or push) our preferences, desires, ideas and opinions towards ends that we often serve unwittingly. This is an important point of view and one that needs careful consideration.

It's a case of: “Behaviourism is dead! Long Live Behaviourism!”

If there are limitations to this valuable critique of teaching machines it is, perhaps, that the idea of personalised learning, the subtitle of this book, does not get quite enough detailed critical attention that the reader might expect. We are also left unsure about the details of programmed instruction methods using the 'old' media of paper rolls, punched card discs, projected slides and so forth so that we might ponder how much of that early work has been carried forward. There is also a lack of illustrations leaving the reader to somehow imagine the various machines described in the text but which are nowadays quite unfamiliar. Perhaps MIT Press could have included more. Audrey Watters has curated a good collection of images and technical descriptions on her blog (for example see [this page](#)) and more of that material could have been included to enhance this noteworthy book.

Reviewed by David Longman

David Longman



Now retired, began his career as a primary school teacher around the time the Micros in School Scheme was set in motion by the Department for Trade and Industry. He later moved into teacher training as a subject leader for IT, then ICT, and finally just before my retirement the Great Curriculum Change in 2012 led to a new title: subject leader for IT & Computing.

During his career he worked with a wide range of students across nearly all phases and levels of education. Much of his teaching work centred around undergraduate and postgraduate teacher training (primary and secondary), MA and doctoral courses as well as adults with learning difficulties. Course development and planning formed a natural part of this background as it does for all teachers and lecturers. This included development of MA programmes and modules, online CPD support and accreditation, schemes of work and assessment frameworks.