

Digital Technologies: An Effective Educational Change Agent?

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Naturally Resistant

Although many in education would argue that we are in a constant state of flux the changes, irritating though they may be, are often superficial. As Papert (1993) has argued the education system is highly resistant to change. The proposition explored in this chapter is that digital technologies can act as a change agent, a galvanising force in a way that other previous innovations have failed to do so. This places high expectations on the use of the technology but can it deliver? There are still many who doubt the usefulness of such technologies in the classroom, yet we are very accepting of digital tools in our daily life. Why is this the case? While plotting a timeline of technological development, and even projecting into the future, is a relatively simple task, assessing the impact of those technological developments on teaching and learning is far more problematic. The underlying ambivalence to the educational use of technology makes future projections difficult, and at first sight the prospects are not encouraging.

A Brief History of Digital Technology

Learning technologies are not a recent idea although it is no easy matter to identify their inception; they are as old as written language itself (Westera, 2010). For a long time the slate and the chalkboard were the dominant educational technologies, but the twentieth century proved to be a century of rapid technological advance inside and outside of the classroom. First technologies such as film and radio were added

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to the teacher's toolbox, and then, towards the end of the last century, digital technologies first crept and then thrust themselves onto the educational scene. Digital technologies are different from previous technologies in a number of ways not least because they are in a constant state of rapid evolution. This is clearly illustrated by Apple's i-Phone. Just a few years ago Apple released this touchscreen 2G (second generation, that is, digital) mobile phone, which I purchased with pride. It was not just a phone of course; it came with Internet access, a camera, note pad and much more. It was a communication system and mini-office all rolled into one. Four years on and my i-Phone became a poor relation of its 3G cousin the i-Phone 3. As is the way of each new generation of such technologies, the i-Phone 3 was of course faster and had greater memory capacity and enhanced functionalities such video capture and streaming alongside the still image camera. However it too has been superseded by new generations of i-Phones. My first-generation i-Phone is not able to play the cult game "Angry Birds" nor does it allow me to access You-Tube clips or have face-to-face real-time conversations.

That such an iconic object as the original i-Phone became effectively obsolete in less than 4 years, and its successor in even less time than that, graphically illustrates the speed and nature of technology development, which, on the whole, have improved what already exists and also added new functionalities. These new functionalities have resulted in a rapid move towards the personalisation of content, where every user has his or her own custom distribution channel. However, although the technology has become more powerful, that is, it has more on-board memory, a more powerful central processing units (CPU), and most significantly wireless network access, we find activities such as playing "Angry Birds" or sending short video clips absorb all the additional power. This has resulted in a new industry supplying digital storage space in the "clouds". Large clusters of networked servers supply vast processing power and storage capacity at low cost removing the need for large personal data stores for your personal images or music files (Johnson, Levine, & Smith, 2009).

So the technology is faster, more powerful and has greater functionality at a reduced cost, and yet it still disappoints because we want more.

And the Impact of That Technology Is?

As technology has spread through our society new behaviours and new ways of working have emerged; for instance mobile phones have become indispensable to the operation of small independent businesses. This is how we now contact our local plumber or electrician (Crabtree & Roberts, 2003). Further it has become a ubiquitous tool of the young. In the UK over 90 % of all 11–21-year-olds had access to a mobile phone (Haste, 2005), and by 2006 49 % of 8–11-year-olds and 82 % of 12–15-year-olds had their own phones (OfCom, 2006). Moreover, 82 % of 8–11-year-olds and 93 % of 12–15-year-olds spent time texting. Texting has become such a widespread and valued activity among many young learners (c.f., Plester & Wood, 2009).

Typically 16–24-year-olds spend more time on their mobile phones and social networking sites than watching television (OfCom, 2010).

Other changes have been seismic shifts rather than modifications of behaviour. For example, few would have predicted the impact of technology on news reporting, an impact that has led to the rise of the citizen reporter. Armed with a camera phone anyone can be both reporter and editor of current events. What was once hidden is now exposed across the world on You-Tube, often before the official news networks. Such changes necessarily affect the structures of a society. The result is that institutions find themselves unable to handle key changes in the rhythms and patterns of emerging human behaviours, and so new or transformed institutions emerge. Thus the Iranian Government made a huge effort to block images and news reports of the violence following the 2009 elections, but there was still leakage of news (Palser, 2009). However in the USA political structure was transformed post the 2008 presidential elections, which were won and lost in cyberspace. The now US President Obama had three times as many supporters signed up on Facebook than his republican rival John McCain, and 500 million blog posts mentioned Obama compared to 150 mentioning McCain (Aronson, 2012). Obama managed to do what many politicians in the West have failed to, that is, engage a new generation in politics by using their preferred communication tools.

And the Impact on Education Is?

Learners of all ages are exhibiting new behaviours as a result of these ubiquitous high-functioning technologies. Changes may be relatively mundane, such as replacing the school satchel with a memory stick, or profound, as when learners seek out expertise beyond the traditional classroom or move from text to more visual modes of representation. For example we reported on two primary schools, both of which were linked to the same theatre group in order to write a play as part of the web play project (Underwood et al., 2005). While significant, these changes are not necessarily transformational, but it could be argued that given the formal framework of education such transformation may not be possible. Lowendahl (2009) argues that the education system has a history of resistance to change, a resistance born out of disappointment when the “hype cycle” of technology in education fails to deliver. This cycle which starts with a techno-romantic phase often leads to disillusionment when the technology fails to deliver nirvana. There is then a need to pass through to a slope of enlightenment, that is, to make a realistic assessment of what technology can and cannot do, before reaching a plateau of productivity when the technology actually delivers to realistic goals.

Both students and tutors have been shown to underuse many high-level functions such as the communication tools (Sclater, 2010), and teachers often find the more advanced functionalities difficult to customise (Severance, Hardin & Whyte, 2008). Our own research has shown that while there have been significant advances in educational technology they have not always brought about measurable shifts in

user behaviour. A study of learning platform use in eight technically savvy English secondary schools (Underwood & Stiller, 2014) showed that while teachers' intentions to use the range of functions available to them on the learning platform varied from extensive to as little as possible, those expressing a desire to use the system creatively found themselves held back by mundane barriers associated with time, personal skills and curriculum demands. Innovative uses of blogs, wikis, and other tools remained aspirational at best even in these schools where technology innovation, at a surface level at least, was actively encouraged.

So while Lowendahl calls for more realism and less hype in technology innovation and acceptance, Westera (2010) argues that the main barrier to effective embedding of technology is a little too much realism. The computer has been used as a sensible teaching aid, quite useful for a specific subset of learning activities, but it has never challenged the educational system as a whole. Resnick (2006) picks up this argument by raising the following question: "Which is the odd one out: the television, the computer or the paintbrush?" He argues that the potential of digital technologies will not be realised until we think of them as modern equivalents of the paintbrush and not as televisions. That is, we need to start seeing computers not simply as information machines but also as a new medium for creative design and expression.

Although those of us who teach see ourselves as innovators, the truth is that change in education is very slow. Seymour Papert (1993) graphically depicted the immovability of education in his story about surgeons and teachers. He argued that a surgeon from a century ago would not recognise a modern operating room but while a teacher might be puzzled by some of the resources in the new classroom, he or she would nevertheless feel at home. Papert posed the question as to why, when so much has changed over the last century, there has not been a comparable change in the way we educate our children. It is not because new tools, the equivalent of the surgeon's heart monitor machine, do not exist. So is it because teachers are inherently resistant to change? While we are cautious professionals we are not Luddites,¹ entrenched opponents of change. The slow pace of change is more to do with need. Medical practice needed to change because people were dying, but traditional methods of teaching do result in children learning, so why are we in such a hurry to change?

So Why Change?

From Aviram and Talmi's (2005) point of view, the centrality of digital technologies in education is both assured and inevitable. That perceived inevitability is built on the assumption of the omnipresence of ICT in our everyday lives and the rise of the generation of digital natives (Prensky, 2001). Indeed Prensky argues that today's students are no longer the people our educational system was designed to teach.

¹Luddites: Workers who violently resisted the introduction of new machinery into the textile industry in nineteenth-century England.

Teachers are told that they have to attract students' interest and attention (Simplicio, 2000), recognising that learners are growing up surrounded by video games, mobile phones and other digital media, all of which are leading to new learner expectations of an acceptable educational environment (Pedró, 2006). However, Watson (2001) queries the automatic link made between the everyday and educational uses of technology, as it does not take into account the fact that technology often fits uncomfortably with teachers' professional judgments. In support of Watson's analysis, the evidence shows that technologies that move teachers outside their comfort zone tend to have a slower take-up and high rejection rates. The conclusion from our own work is that positive impacts are more likely when linked to a teacher's existing pedagogical philosophy, hence the rapid acceptance of interactive whiteboards (IWB) compared to virtual learning (Underwood et al., 2010). Indeed half of the teachers we interviewed identified the IWB as their "must-have" technology. However, some teachers expressed unease with this position, for example stating "IWB and PowerPoint, sadly", acknowledging that there were other more exciting ways of using technology although they were not exploiting these opportunities themselves.

The discontinuity between teachers and technology may be more deep-seated than a clash with professional practice though. It may lie in the nature of those who choose to teach. For example, it is not age or sex but membership of the teaching profession that is the defining characteristic of low involvement with video games (Sandford, Uiksak, Facer & Rudd, 2006). Books are the preferred tool of this group as a whole. If teachers, as a group, are inherently low technology users compared to the general population, does this mean that there is a natural resistance to the embedding of technology into the educational processes and practices? While this rather negative portrayal of the teaching profession may be valid in some cases, our evidence of a decade of national research projects presents a more positive picture of a profession that is cautious but constructive in its approach to innovation.

Three Possible Ways Forward

It has long been argued that any good teaching system aligns the teaching method and assessment to the stated learning objectives (Lebrun, 2007). How do we achieve this alignment? There are broadly three strategic responses to the demands to go digital (Underwood & Dillon, 2011).

1. *Minimise the use of technology*: This approach minimises the demands on teachers and maintains the status quo. However, such a strategy raises very real issues of equality. Those learners with access to technology outside of the school will be advantaged, leaving a digital underclass of learners who lack either the economic or the cultural support that would make these technology tools available to them.
2. *Use technology to support current practice*: Accept technology where it fits current educational structures and practices. This approach recognises technology as a useful tool in the right place but removes the role of catalyst for change. So we find that some innovations are more readily assimilated into the classroom than

others; for example digital whiteboards is a case in point. However other ubiquitous technologies such as 3G phones have minimal impact (Wang, Shen, Novak, & Pan, 2009) and are resisted by teacher unions (Robinson, 2010). This way forward feels comfortable and of course is in widespread use. However, there is an inherent risk that such use will lead to learner disaffection and rejection of the educational process, particularly in the case of the digitally savvy learner.

3. *Merge and evolve*: Here, we educators allow ourselves to adapt and respond to the possibilities afforded by the technology and embrace innovation. The approach recognises that digital technologies necessarily require us to reassess how learners learn and teachers teach. From this perspective we need to think about how schools or learning ecologies are organised, including the role of technology, to support meaningful student achievement. Schools will move to be more open educational institutions that “dramatically change their views on knowledge, assessment and the teacher, student and information relationships” (Hernandez & Goodison, 2004, p. xvi). One such example is the emergence of the personal web that will allow learners and teachers to customise the web to their own needs and interests using a range of data management and tracking tools. A second example would be the simulated contexts provided by virtual environments in which participants interact with digital objects and tools, such as historical photographs or virtual microscopes (Clarke-Midura & Dede, 2010).

But Even If We Decide to Merge and Evolve?

The Perils of Joining the Net Generation

In 2009 a comparison of faculty and student responses indicates that students were much more likely than faculty to use Facebook and were significantly more open to the possibility of using Facebook and similar technologies to support classroom work. Faculty members were predisposed to use more “traditional” technologies such as email (Roblyer et al., 2010). However, there are tutors who have joined the Facebook generation, and in doing so they have taken the decision to merge and evolve. However, this brings its own perils. Just as we, the tutors, begin to feel in charge of the technology we are reminded that the potential risks of the digital world are not just for learners but for tutors as well.

A study by Sleigh, Smith, and Laboe (2013) of students’ responses to tutors’ Facebook pages is illuminating. They examined whether the specific type of self-disclosure on a tutor’s profile would affect students’ perceptions of the tutor including their expectations of the tutor’s classroom practice. Students reported being most interested in professional information on a tutor’s Facebook profile, yet they reported being least influenced by that professional profile. They found that tutors who were seen as social individuals had high popularity ratings but the sting in the tail was that, although their profiles were viewed as entertaining, they were judged as inappropriate for a professional. This perception resulted in such tutors

being assessed as less skilled professionally. It would appear that students form perceptions about the classroom environment and about their tutors based on the specific details disclosed in tutors' Facebook profiles.

So while tapping into students' interest SNSs may be an effective way for tutors and institutions to communicate and stimulate their students (Junco, 2011), the technology can be revealing and the students' developing perceptions and expectations may not always be what we intended or desired.

And Then There Are MOOCs

Massive open online courses (MOOCs) may seem somewhat tangential to what has gone before in this short piece, but they raise considerable issues for educators and possibly learners too. They are the dream scenario:

Nothing has more potential to unlock a billion more brains to solve the world's biggest problems. And nothing has more potential to enable us to reimagine higher education than the massive open online course, or MOOC, platforms that are being developed by the likes of Stanford and the Massachusetts Institute of Technology and companies like Coursera and Udacity. (Friedman, 2013, page SR1)

So what are MOOCs, and why are they arousing such interest? MOOCs have been developed to support large-scale, open-access participation that includes varying levels of interaction. While such systems can appear prosaic at first sight, delivering traditional course materials such as videos, readings and exercises through the web, it is the use of interactive user forums designed to build a community of learners and tutors that elevates the MOOC from a delivery system to a new approach to knowledge and learning. Such knowledge, according to Downes (2005), is created by interaction and is not simply a relationship or a distributive pattern between one fact or idea and another. In essence connective knowledge is knowledge of the connection.

For a connectivist dynamic system to exist, Downes (2005) argues that there must be learner autonomy, group diversity, openness and interactivity and connectedness defined as follows:

1. **Autonomy**—The level of learner autonomy must be high, and the learners must be more than simply managed participants who receive rather than create of knowledge.
2. **Diversity**—The community will have a diverse membership and not be a self-perpetuating in-group maintaining the status quo and stifling new ideas and connections.
3. **Openness**—This will support free-flowing communication at various levels of activities with easy access for participants with no clear boundaries between membership and non-membership.
4. **Interactivity and connectedness** will produce knowledge that is unique within the community. Such knowledge will very likely be complex, representing not simple statements of fact or principle, but rather reflecting a community response to complex phenomena.

However, this utopian dream often falls short even in networks that are open and allow autonomy as only certain perspectives of those of participants occupying the highly connected nodes tend to be circulated to the network as a whole for consideration.

The University of Manitoba delivered an early interpretation of the MOOC principles in the autumn term of 2008. Predicated on this new perception of knowledge and way of learning “connectionism” (Downes, 2005; Siemens, 2004), CCK08 was designed to enable participants to engage with the theory and practice of connectivism. Over 2,000 participants signed up for the course, including Mackness, Mak and Williams (2010) who were keen to explore the Downes’s model of learning in practice. They found that all four characteristics of a MOOC, autonomy, diversity, openness and connectedness/interactivity, were present in the MOOC, but that they did not necessarily lead to an effective learning experience. The more autonomous, diverse and open the course, and the more connected the learners, the more the potential for their learning to be limited by the lack of structure, support and moderation normally associated with an online course. These students fell back engaging in traditional groups as opposed to the open network. The finding that there can be too much autonomy has already established in other learning situations (Underwood et al., 2010). These responses constrain the possibility of having the positive experiences of autonomy, diversity, openness and connectedness/interactivity normally expected of an online network. The research suggests that the question of whether a large open online network can be fused with a course has yet to be resolved. Further research studies with larger samples are needed, as is an investigation into the ethical considerations that may need to be taken into account when testing new theory and practice on course participants.

However, the nightmare scenario would see MOOCs as leading to the demise of universities, colleges and even upper secondary or high school education

I believe that online education will be an important building block of teaching in the future...I see great potential in having the opportunity to learn no matter where you are. You don't need to be in school or in a lecture hall of a university anymore, and therefore I believe that this will dramatically change our lives.

(Dr. Angela Merkel, Chancellor of the Federal Republic of Germany (<https://moocfel-lowship.org/> 2013, no page)

One cannot deny the size of the MOOC impact on higher education, for example:

Mitch Duneier, a Princeton sociology professor, wrote an essay in *The Chronicle of Higher Education* in the fall about his experience teaching a class through Coursera: “A few months ago, just as the campus of Princeton University had grown nearly silent after commencement, 40,000 students from 113 countries arrived here via the Internet to take a free course in introductory sociology. (Friedman, 2013, no page)

Further the first UK-based MOOC platform, Futurelearn, is intended to go live in autumn 2013. It will be populated by MOOC courses designed by its 21 member institutions. It is estimated that it will cost about £30,000 (35,000 euros) to develop a MOOC for this platform (Parr, 2013a). While MOOCs can be linked to other tools such as Facebook such linkage can result in negative consequences. For example,

Kop, Fournier and Mak (2011) found that students had privacy and security concerns about Facebook. It would appear that the level of trust, feelings of confidence and the sense of presence and community are crucial to students engaging with the system, and Facebook leaves them uneasy.

But There Is a Twist in the Tail

Completion rates for MOOC courses, defined by the number of students being awarded some form of certificate, are alarmingly low. The Times Higher Education quotes an average figure of 7 %, that is, 93 % of students failing to complete such courses (Parr, 2013b). There is significant variation in these rates as is shown by the following three courses, all mounted on Coursera (Jordan, 2013). A History of the World course at Princeton University which ran 2012–2013 is recorded as having the poorest completion rate at 0.7 % of students enrolled; that is, 581 of the 83,000 who enrolled were certificated. However the University of Edinburgh had a completion rate of 2.3 % for its Artificial Intelligence Planning in 2013, that is, 660 students out of 28,689 students enrolled on the course. The most successful course in terms of completion rates according to Jordan was a course in Functional Programming Principles from the Ecole Polytechnique Fédérale de Lausanne from 2012-09 to 2012-11. Here 19.2 % completed the course, that is, 9,600 students out of the 50,000 who enrolled.

The headline findings from Jordan's (2013) data are encouraging for those who would hold back the march of online teaching and learning. However, look deeper and you will see that the World History course made assignment completion optional. This suggests that the course was designed with more than one audience in mind. Yes there were students of history seeking qualification, but there were also those who were simply interested in the topic, many of whom I would surmise are learners of the third age, that is, retirees coming back to a subject that interested them in the past but was not seen as providing job skills when younger. How many students are enrolling on these courses as top-up, tasters or as a hobby is yet to be established. The findings from the Edinburgh and Lausanne courses might be of greater concern, as these are not "hobby" subjects for most people. However, even here the numbers passing the course are not insignificant; 9,600 completions in the case of the Lausanne course should not be viewed as an inconsequential with the potential to impact on more traditionally provided courses. That really is cost-effective education.

Where Do You Stand?

Attempts to bed in new technologies necessarily involve some level of disturbance to the educational system. The degree to which these perturbations are tolerated will affect technology acceptance. This raises the question of whether the educational

system will allow itself to be transformed or not although the rise of MOOCs may take these decisions out of the hands of educational establishment at least at the university level even if schools are more future proof.

Of course there is always that cynical old “truism”. In the UK education circles it has long been the belief that universities will survive all educational revolutions because in the end the middle classes have to send their children somewhere to find suitable husbands and wives. With the advent of social networking and online dating even this role is now under threat.

The equally cynical view of schools as state-provided babysitting services has yet to be questioned although one can see the rise of plugged-in children. In the end if we do not adapt then for some learners the educational system will become increasingly irrelevant and they will carve out a learning environment for themselves, dipping into the formal system only when they see the need. As Prensky (2001) points out we ignore the fundamental fact that in a digital world the students themselves have changed. Will we as educators change with them or will the majority of us become increasingly less relevant?

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