

Rewiring schools versus re-schooling society

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Abstract

The purpose of all forms of technology is to help change our world and so it is natural that discussions about technology should have a political or philosophical quality. In this paper I discuss the relationship between the introduction of information technology in schools and change in education. The evidence of at least one major study suggests that the provision of computers and the internet, unaccompanied by deeper reforms, does not produce a significant transformation. I argue that the resilience of schools to technologically-led change is unsurprising and might even be celebrated. Nevertheless, as the twenty-first century unfolds it will become ever more important to review the purposes of education and the practices of schools. The case for radical change — in effect a re-schooling of society — is strong, but change must be motivated by a coherent educational and not merely technological vision.

Introduction

Forget computers and schools for a moment and think about technology in a very general way. Technology is the application of science to change some aspect of the environment, such as the workplace, home or countryside. Its fundamental concern is with the design of tools. Humans differ from other living species in that our tool-building has always been ceaseless and ingenious, from levers to lathes, from matches to microchips, from railways to robots.

That is not to say that our tool-building has always been *wise*. One recurring property of technology is that its full range of uses and their implications can be very hard to foresee. An illustration is the case of refrigerators and aerosol sprays, products that were thought to be innocuous until we learned how their chlorofluorocarbon gases (CFCs) were damaging the health of the planet. A second recurring property is that the change which a technology is expected to achieve may be in the interests of some groups in society but not others. This was well understood by the nineteenth-century weavers known as Luddites who sought to destroy the steam-powered knitting looms that arrived with the industrial revolution. Although they had a bad press, the Luddites deserve our thanks for reminding us that the benefits of technology may not be clear-cut. The eco-warriors who campaign against genetically modified crops, motorway construction and nuclear power plants, provide that service today.

The technological is political. The technology that a society develops (and the way that technology is used) reflects not just the inventiveness of technologists, but also the outcome of a political process. The insight that technology both shapes *and is shaped by* society is important if we are to avoid the trap of 'technological determinism'. This is the view that technology is somehow an independent, self-generating force with inevitable consequences for change that people can only pragmatically accept. Technological determinism may be a widely-held view but it is mistaken in ignoring the human shaping of technology and it undermines our sense of responsibility for change and our capacity to influence its course.

Information technology and schooling

These reflections on technology, general though they are, suggest questions that we can ask in regard to the specific context of the introduction of information technology in schools. What is the purpose of this technology, and in whose interests is it being introduced? What evidence can we find that the technology is having its intended effects, and what unintended effects are apparent? In what way is the technology shaping our schools, and in what ways are our schools shaping the design and use of technology?

Perhaps the surprise is that such fundamental questions are discussed so little. After all, change in education is an important matter. We now have two decades' worth of experience of IT in schools. In the UK, and perhaps in other countries where the noise of school rewiring has reached a crescendo in the last few years, IT accounts for massive expenditure. Government departments regularly broadcast the latest advances in the provision of technology. But they are much less clear on the rationale for and direction of the change that the technology is supposed to support.¹

Larry Cuban's study

A rare example of a study that does ask such fundamental questions is Larry Cuban's recent book *Oversold & Underused: Computers in the Classroom* (Cuban, 2001). The polemical title announces a conclusion that was reached by a scholarly investigation of the infusion of computers into US schools, specifically schools in the Silicon Valley area of California. Silicon Valley, of course, is a hotbed of information technology and as might be expected, schools in that area feature a ratio of students per computer that far exceeds state and national figures. If rewiring schools does produce a transformation of schooling then we might expect to find the evidence more clearly manifested in Silicon Valley than elsewhere.

Cuban identifies the promoters of technology as a disparate but powerful coalition of assorted public officials, corporate executives, vendors, academics, education policy makers and parents. Their shared intentions were to change schools through technology but the specific goals were diverse. Some, especially public officials and corporate executives, sought to make schools more efficient and productive, just as (in their opinion) had been achieved by information technology in industry. Others, including some academics, believed that teaching and learning with technology would become more student-centred, constructivist and engaging. A third goal, favoured by parents and politicians among others, was to prepare the current generation of young people for the future workplace. The assumptions uniting the coalition were that if technology was introduced to schools then it would be used, and the resulting change would be significant.

Cuban describes the coalition as 'astonishingly successful' (p17) in wiring schools and equipping them with computers. But his study of Silicon Valley schools causes him to question whether the goals have been, or will be achieved. In terms of efficiency and productivity, Cuban argues that none of the advances as measured by higher academic achievement of students can be confidently attributed to increased access to computers. With regard to transforming teaching and learning, he reports that teachers generally have been only infrequent and limited users of the new technologies in their classrooms. Such use of the technology as has occurred has been

¹As an example, the Scottish Executive's recent *Survey Of Information And Communication Technology In Schools 2000* headlines the news that between October 1999 and October 2000 the percentage of computers in Scottish state schools that are over 4 years old has fallen in each of the pre-school, primary, and secondary sectors. We are also told that the percentage of schools with access to the World Wide Web has increased across all sectors between those dates and one in five secondary schools now has a broadband connection to the internet. However, the survey tells us almost nothing about the way these things have changed children's experience of schooling. <http://www.scotland.gov.uk/stats/bulletins/00128-00.asp>

basically to continue what teachers have always done: prepare courses and classes, communicate with parents and administrators, record grades, and so on. As for the goal of preparing young people for the future workplace, a large growth has occurred in classes that teach keyboarding and commonly used software but the significance of these classes is not very clear. This is because experts disagree on the meaning of computer literacy, students' learning of technological skills has come from other sources (notably the home) and not just from school, and the effect on students' eventual competitiveness in the workplace is very uncertain.

So the pro-technology coalition has had its way — the computers have been installed and the schools have been wired to the internet. But in terms of real change it seems that not very much has been achieved. Of course it is possible to argue that the technology revolution is a slow one and now is too soon to announce the result. Cuban however claims that the explanation lies more fundamentally with the shallow understanding of schools that has been displayed by the coalition. He concludes:

Although promoters of new technologies often spout the rhetoric of fundamental change, few have pursued deep and comprehensive changes in the existing system of schooling. The introduction of new technologies into schools over the past two decades has achieved neither the transformation of teaching and learning nor the productivity gains that a reform coalition of corporate executives, public officials, parents, academics, and educators have sought. For such fundamental changes to teaching and learning to occur there would have to have been widespread and deep reform in schools' organisational, political, social and technological contexts. From my inquiry into Silicon Valley schools I have concluded that computers in classroom have been oversold by promoters and policymakers and underused by teachers and students. (p195).

A view from Silicon Glen

It would be interesting to duplicate Cuban's study in other countries, to see whether the same pattern of superficial change applies elsewhere. I have not conducted such a study in Scotland but I would be surprised if the situation was dramatically different. The same kind of pro-technology coalition, whose shared enthusiasm for the wiring up of schools masked a very disparate set of goals, has had its way, but the large budgets seem to have produced only modest outcomes. The academic achievement of Scottish school students has been rising (on some measures) but nobody seriously credits this to greater access to computers. Teachers' use of computers is generally very limited and in secondary schools the vast majority of lessons are probably untouched by technology. And just as in Silicon Valley, the schools of Silicon Glen now offer a large number of lessons aimed at learning forms of IT. But the value of these lessons, which more often than not separate the learning of technology skills from the contexts that could make the skills meaningful, is rather questionable. So too is their relevance to the economy of Silicon Glen where for the last three years IT companies have actually been sacking workers and closing doors at an alarming rate.²

Nor did Cuban's conclusions much surprise the group of Scottish teachers which whom I discussed them recently. Although their schools like most others had experienced the upheaval that comes from the wiring up and installation of computers, when the dust settled they did not detect any change in the circumstances that mattered most. Yes, they had email addresses, access to the internet, a PC in each classroom, and there was a computer lab somewhere in the building that could be booked by any teacher (but only when it was free of IT classes and the network was not 'down'). But consider what had stayed the same: the structure of the curriculum; the strict

² Major job losses or closures in the last year alone have affected companies including 3 Com, Adobe, Agilent, Cadence, Cap Gemini, Cisco, Compaq, IBM, Microsoft, Motorola, National Semiconductor, NEC, Oracle and Sun. The Scottish Executive has claimed that a switch is underway from large plant investment to R&D, but it is far from clear how R&D can secure jobs in anything like similar numbers. *Business Scotsman* 20 December 2001.

division of teachers into subject departments; the arrangements for courses and assessments; the organisation of the school day; the headteacher's steely focus upon examination targets; the traditional expectations of parents; the school inspectors' regular probing for possible deviations from government guidance. All these things were as before. The new technology was nice in some ways and a small minority of enthusiasts was experimenting with new methods, but just as many found it unusably complex³ and to the majority it seemed barely relevant.

Celebrating resilience

Cuban's study will disappoint the coalition that promoted technology in schools. But I think the findings are unsurprising. The literature on educational innovation emphasises that schools are complex institutions that have evolved practices which balance many different demands. According to Fullan (1991) large-scale change is successful only when adequate account is taken of teachers' existing methodology, materials, and beliefs. The technology coalition, insofar as it communicated with teachers at all, did not persuade the majority of them that its disparate purposes and hazily specified strategies were sound. Nor did the new technology adapt easily to teachers' methods, especially in high schools where 'whole-class' teaching finds little use for a single classroom computer. Perhaps had the option been open to teachers, many of the technology gifts would have been returned and exchanged for something else. Lacking that option the computers were ignored, or else applied to modest tasks for which they seemed to be useful, such as report-writing and sending email.

This outcome can be read negatively, as Seymour Papert does when he attacks what he sees as school's organised resistance to change. Papert likens school's response to the computer to that of a living organism which, defending itself against a foreign body, digests and assimilates the intruder (Papert 1993, p40). A different kind of hostile response — one which can now be detected in the statements of frustrated school inspectors and politicians — is to 'blame and train'. Teachers who are portrayed as incompetent or obstinately negligent towards the technology are to be cured by a diet of 'retraining'. But there is a more positive reading of the situation, one that acknowledges that school's resilience to the grand designs of external coalitions is in part healthy. The pro-technology coalition sought to make technology the primary driving force of change — a classic case of technological determinism. Teachers have demonstrated that they can think for themselves and they are powerful in mediating the effects of technology.

A second reason why we should celebrate resilience is that Orwell, Huxley and many others have properly warned that technology can be harnessed to visions of hell. In 1984 Orwell presents technology as an instrument of thought-control. One can easily imagine a sinister role for IT in education, for example the use of computer networks to implement forms of 'online learning' that enforce a cheap, centralised and state-controlled oppressive curriculum, or the use of computer monitoring to track nonconformist teachers and students. Huxley's *Brave New World* presents a very different hell in which technology delivers endless distracting entertainment, leading ultimately to the trivialisation of culture and a paralysis of critical thinking. According to Neil Postman (1986), whose book *Amusing Ourselves to Death* relates the Huxleyan vision to the 'dumbing-down' effect of television on US society, this is a more serious threat than Orwell's. Arguably however, even television is trumped by information technology in its obsession with the trivial or ephemeral. Consider the endless stream of amoral computer games; the unceasing pursuit of novelty and glitz by vendors and customers; the dot-com fantasy economics; the

³ Some technology experts share the view that today's computers are too hard to use. Notably, Don Norman (1998) argues that the problem of over-complexity is inherent in general-purpose information machines. He points to the growth of dedicated appliances, like games consoles, calculators, digital cameras and music keyboards, as representing a trend that will eventually supersede PCs.

frenetic, seedy and lawless internet that has become a paradise of consumerist pleasure-seeking; and the seductiveness of 'edutainment' software.

I do not claim that the grand designs of the pro-technology coalition were Orwellian or Huxleyan. More likely the coalition has been merely patronising, ignorant and inept. But Larry Cuban's study shows that schools will not easily be manipulated by technology-led change and that is probably healthy.

The case for change

So far, this paper has presented the view that the most likely outcome of existing developments of technology in schools is a type of change that is merely superficial. The rewiring of schools, unaccompanied by deeper reforms, will not produce a significant transformation of schooling. None of this, however, should be taken to imply satisfaction with the status quo. In fact schooling in Scotland (and perhaps elsewhere) suffers from some deep-seated problems that justify consideration of radical change.

Some of the most worrying signs of trouble are the figures for truancy, indiscipline and exclusion. Consider some Scottish statistics for session 1999/2000. Primary school pupils truanting for 466,000 half days and secondary pupils truanting for 1,300,000 half days.⁴ Around 40,000 secondary pupils were temporarily excluded from school and on average every pupil in an urban secondary lost one half day to temporary exclusion. An estimated £30m was paid out to cover teachers on sick leave, a high proportion of which is believed to be stress-related.⁵ Over 3,000 violent incidents were recorded by schools, more than 60% of which involved physical violence on teachers by pupils. The government's recent response includes a £10m fund to build 'sin-bins' for unruly pupils. These however will provide teachers with little relief from the less dramatic but emotionally draining minor acts of misbehaviour that they encounter on a daily basis (Munn et al 1998).

Most of these indicators appear to be getting worse and I do not think that it is an overstatement to claim that they reflect a kind of crisis in schooling. The picture could be made still more depressing by mentioning, for example, Scotland's poor showings in various international comparisons of educational performance; the problems of personal development education that are highlighted by data on teenage pregnancy, drugs, alcohol and ill-health; and the difficulties that surround the recruitment and retention of teachers. However, some sense of perspective is necessary. Any assessment of Scottish schooling must also acknowledge such positive indicators as the steadily rising rates of staying-on beyond the minimum school leaving age, the improving levels of qualification achieved by pupils, and the greatly increasing proportions of pupils now entering tertiary education (Paterson 1999). Also, the raw statistics conceal some very sharp distinctions between urban and rural areas, middle class and working class pupils, and males and females. Roughly speaking, the indicators are most negative among working class, male pupils in urban schools.

Of course, the league tables of school performance so beloved by some newspapers and politicians correlate closely with the socio-economic characteristics of their catchment areas.⁶

⁴ Scottish Executive data, 18th December 2000. <http://www.scotland.gov.uk/library3/social/sjaip-12.asp>

⁵ Times Education Supplement Scotland, 14th December 2001.

⁶ As an indication of the extent of the variation, consider the fact that during 2000-2001 52% of school leavers took up full time tertiary education places. This is made up of 32% going on to full time higher education and a further 20% taking up further education. For state schools, East Renfrewshire had the highest proportion (53 per cent) of school leavers entering into higher education whereas Glasgow has the lowest figure of 20 per cent. 91 per cent of young people who left independent (private) schools continued onto full-time further or higher education. Scottish Executive data, 18th December 2001. See <http://www.scotland.gov.uk/stats/bulletins/00131-00.asp>

This is one explanation for why politicians and middle-class professionals do not show a greater state of alarm: their children typically do not attend the schools where the crisis is most obvious.

The postmodernist critique

The causes of the problems afflicting schooling, and also their gravity, are arguable. Predictably, Scottish school inspectors point to examples which seem to show schooling at its best and urge that this 'best practice' be replicated elsewhere. But this approach to educational reform has never really been satisfactory. There is a limit to how far practices can be transferred between different contexts and the designation of certain practices as 'best' has often seemed arbitrary. But in any case, as the cracks in the system become wider so it becomes less credible that the answer can lie with a mere narrowing of differences.

A more principled, and I think plausible, analysis comes from the postmodernists such as David Hartley (1997) who claim that existing patterns of schooling are increasingly at odds with far reaching changes that have affected society. Hartley contends that schools are essentially monuments to the industrial revolution.⁷ The progress of pupils through school, in lock-step style by chronological age, mirrors the clockwork flow of part-built cars through Henry Ford's assembly lines. The organisation of school into a familiar set of subject departments reflects a traditional view of knowledge with which Ford would have been comfortable. The standardisation of courses and assessments, controlled by targets and monitored by inspections, resembles an efficient mechanism for quality control that he would have admired. The school's visible and hidden curriculum expresses a set of certainties about the world, and each person's place in it, that may have been justified by the perspectives of a century ago.

But times have changed. In Scotland as in other western countries most of the jobs that followed the industrial revolution in steel making, coal mining, shipbuilding and car manufacturing are gone. Young men can no longer expect as their grandfathers did that a trade once learned will provide a lifetime's employment. Frequent retraining and job-switching will be normal. The jobs that are on offer are less often in mass production and more often in the service or leisure sectors that were traditionally dominated by women. The uncertainties are compounded by a globalised economy that seduces even children as customers. Glitzy media messages delivered by television heroes sell infinite choice. Children are growing up faster into young adults who aspire to be mobile, entrepreneurial, acquisitive consumers. People are much less committed than their ancestors were to their neighbourhood communities and adherence to the old institutions — the churches, the trade unions, the political parties, the extended families — is much weaker. There is less faith that the 'grand narratives' — religion, socialism, science — can supply answers to people's problems. Meanwhile, in the workplace and in academia, the strict boundaries between subjects seem to fade as team working becomes more common and new, interdisciplinary subjects appear.

Re-schooling or de-schooling

If schools are monuments to the industrial revolution then it is unsurprising that in postmodern times they should look increasingly odd. The talking heads, the monochrome worksheets, the metronome timetable, the compulsory curriculum, the lock-step regimentation of learning — these are all signs that school is out of time with the fluid, shifting patterns and uncertainties of twenty-first century life. In retrospect, the introduction of new technology in schools could be interpreted as an urgent effort to narrow the gap with a quick technical fix

⁷ I am conscious of paraphrasing David Hartley's ideas here in a summary way that risks doing them injustice. I strongly recommend his book.

(Robins & Webster 1989). But if that was the idea, it may have backfired. Youngsters who have unrestricted access at home to better computers than the ones which they (only occasionally) encounter at school may contrast the IT learning opportunities between the two contexts and the result may not be in school's favour.

It might be argued that the postmodernist critique points logically to the *de-schooling* of society that was famously recommended three decades ago by Ivan Illich (1971). Illich saw schools as hopeless, ritualised bureaucracies and he argued for their abolition in favour of 'educational webs'. Webs would be opportunities for voluntary learning supported by 'liberating technologies' — he meant the postal service and the telephone but of course, today's internet would suit his purpose much better. And indeed, much of the more radical rhetoric of IT in education today, for example Papert (1993), seems to be essentially de-schooling in philosophy.

Yet aside from a small (although flourishing) home-schooling movement, in Scotland and perhaps in other countries the vast majority of parents continue to look to school to provide their children's education. Also, if it is true that the old institutions are crumbling then it may seem more than ever essential to bolster the role of schools in contributing social cohesion. Schools express in very concrete terms the idea that society is more than (to borrow Margaret Thatcher's famous phrase) a collection of individuals and families. So it does not seem unduly paternalistic to regard the de-schooling position as excessively individualistic and pessimistic.

The remaining option for radical change is what David Hartley (1997) calls the *re-schooling* of society. In other words, schools should reinvent themselves with purposes and approaches that are transformed to suit changed times.

Towards a transformation

But what are these purposes and approaches? These are more or less exactly the questions that the Scottish parliament has declared will be the subject of a national debate.⁸ I shall offer a few observations about the purposes of education, and the implications for curriculum and pedagogy, before returning finally to my theme of technology.

First, on purposes. A radical reply to the question about the purpose of education would be to reject the question, as John Anderson invited us to do (1980, quoted in Paterson 2000). Anderson argued that education is for its own sake, and that we need to turn the question of purposes around: the purpose of *life*, he said, is to lead an educated existence. The notion of education for itself may seem strange, self-indulgent almost, from our twentieth-century standpoint. It is hard to stop thinking in terms of Henry Ford's assembly lines, where each stage in the process is justified solely by the contribution that it makes towards the next stage. But assembly line schooling has alienated large numbers of young people, as was noted earlier. Thinking about schooling mainly in terms of the human development of individuals, and not in terms of vocational end-products and economic trends, may help us to re-connect schools to their communities. It is also justified by changing patterns of work. Production lines that are operated by robots should give people more time for leisure, culture and relationships. Providing the benefits are fairly shared (a large caveat, admittedly), work should not dominate human lives in the twenty-first century as it did in the nineteenth and twentieth.

Second, on curriculum. In Scotland, the education establishment has often boasted that our school curriculum has five great qualities: it has *breadth, balance, continuity, coherence, and progression*. These qualities are carefully embedded in the framework of subjects and courses

⁸ Scotland's educational policy-making has traditionally been top-down, with school inspectors having the most powerful voice. But the arrival of the Scottish Parliament has brought calls for a more democratic approach, perhaps along the lines of the Irish National Education Convention (Paterson 2000). This latest call for a debate may suggest that the Parliament is willing to embrace change in the way that policy is developed.

that are provided at each stage of school. Thus, the curriculum is a marvel of paternalistic educational engineering. Young people seem to be less impressed, however. Bryce and Humes (1999) suggest that the 'set of five' seems to be missing some qualities that may be more vital to secure pupils' engagement — notably choice, meaningfulness to the individual, and depth. The almost complete absence of choice in particular is one of the most striking contrasts between school and the world outside, where perhaps only prisons do more to prescribe how each day must be played out. If the curriculum is truly supposed to be 'a conversation between the generations' then this conversation seems to be very one-sided — a lengthy lecture, in fact.

Aside from the urgent need to secure the engagement of learners, there are other good reasons why we should seriously consider transforming the curriculum. One is that the twenty-first century seems likely to make a reality of lifelong learning. When there are opportunities to learn any subject at any point in one's life, the claims for what *must* be learned in the years of schooling become weaker. Thus the tyranny of the overcrowded curriculum can be ended. Another reason is that research on learning has emphasised the value of integrating knowledge across subject boundaries, as well as within them (McKendree et al, in press). So a curriculum constructed from a set of discrete subjects seems not only old-fashioned and inflexible but also a hindrance to learning. Perhaps instead of learning subjects we should think about *learning experiences*. Howard Gardner's (1983) 'multiple intelligences' could be developed in many different ways, including by multidisciplinary and project-based approaches, with less time devoted to formal lessons and more to real-life settings (Hargreaves 1998). It can be argued also that the uncertainties of the twenty-first century justify a curriculum that gives much more attention to such areas as thinking skills (McGuinness, 1999), emotional intelligence (Goleman, 1996), and citizenship (LTS 2001).

Third, on pedagogy. Much if not most of the research on teaching and learning has favoured a constructivist or 'learner-centred' approach, with practical implications for teaching that are nicely summarised by Brooks & Brooks (1999) and described in more theoretical terms by the cognitive apprenticeship framework of Collins et al (1989). Roughly speaking, however, it seems that Scottish secondary schools mostly apply transmissional or teacher-centred approaches, perhaps because teachers believe that these approaches reduce the problems of managing disaffected classes and serve well enough for the purposes of assembly-line assessment. This is a vicious cycle that needs to be broken. Students who are given more control over their schooling will respond by accepting more responsibility for their own learning. Constructivist pedagogy, together with assessment practices that focus on promoting growth rather than recording success and failure, can help to change the vicious cycle into a virtuous one in which effective learning enhances self-esteem and encourages responsible, independent attitudes towards further learning.

Summary and conclusion: the role of technology

A decade ago, Spencer (1991) argued that progressive change in education required the emphasis to be placed upon the technology *of* education rather than the provision of technology *in* education. By this he meant that questions about educational purpose, curriculum and pedagogy ought to be answered (or at least, addressed) before we attempt to specify configurations of hardware and software. The evidence from Larry Cuban's study and elsewhere suggests that this did not happen. The coalition of advocates for wiring up the schools was politically powerful and it has had its way. But the coalition's purposes were disparate and its strategies were vague. Teachers and communities were hastened into cyberspace without any clear educational vision of change. The result is that schools have been rewired but schooling has not been significantly transformed.

I have argued that the resilience of schools to technologically-driven change can be read positively, as renewed evidence that the beliefs and purposes of teachers are properly important factors in change. Technology both shapes *and is shaped by* society and schools especially are complex communities that cannot be mandated to change merely by the provision of equipment. But I have also argued that as the twenty-first century unfolds, it will become ever more important to review the beliefs and purposes that we hold for education. Schools that are monuments to the industrial revolution can hardly be equal to the challenge of new times. Along with the world about them, young people have changed. Children have rights under law which the authorities must take seriously. The case for rethinking the purpose, curriculum and pedagogy of school is very strong.

The role of technology is to help us change our world. If we have a coherent and honestly articulated vision of educational change then it is reasonable, and essential, to investigate forms of technology that will help us to achieve that change. Technology is exciting and it offers many possibilities, but we can hardly expect to distinguish the good from the bad unless we have some philosophy too.

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