Beyond cyber-tooth policy: teacher education, ‘old times’ thinking, and computing and communication technologies in schools.

Chris Bigum and Leonie Rowan, Quality Learning Research Priority Area, Deakin University, Geelong.

Abstract
From the early days of computer use in schools, teacher education practices concerned with computing and communication technologies (CCTs) has been consistent with or supportive of policies developed for school use of CCTs. While these technologies have developed significantly since those early days, policy has altered little. The maintenance of ‘old times’ policies is underpinned by, among other things, a limited theorising of school change, a flawed understanding of the take up of any new technology, and institutional amnesia in relation to the reality and rhetoric associated with over twenty years of CCT use in schools. Given the prominence of CCTs in most contemporary thinking about education, any professional regeneration of teaching and learning will need to move beyond these limited and limiting accounts of schooling and CCTs. This is no simple matter given the broad and consistent reproduction of ‘old times’ policies and practices across systems around Australia.

This paper details the flaws in current policies, maps serious problems that need to be addressed and outlines a robust approach to moving beyond the cyber-tooth policies that inform current practices in schools, and hinder any professional regeneration of teaching and learning in teacher education.

In the beginning
In the late 1970’s schools began to make use of a range of what were then called microcomputers. Through the 1980’s, state and commonwealth governments invested in programs to train teachers and provide more computer equipment for schools. The speed with which schools purchased these new technologies and the speed with which various computer-related subjects colonised most school curricula was rapid (Bigum, 1990). This was a time when computer networks were not anywhere near as widely deployed as they now are. Using computer networks for email was relatively expensive and largely restricted to universities. The Web was years away. Few homes had computers and schools were one of the places you could go to find a computer. The most commonly cited rationales for using computers in classrooms were to improve student learning and to improve student chances for employment. This was a time when the patterns of economic and social exchange on the global scale that we know them today were largely non-existent.

Since that time the number of computers and computing-related technologies has increased enormously. The speed and capacities of these technologies has more or less followed Moore’s Law which in its original form says that the number of components on chips with the smallest manufacturing costs per component doubles roughly every 12 months. (Tuomi, 2002). The deployment of these technologies globally has lead to a world in which global finance shapes the options of governments and global entertainment in its various forms impinge seriously on local cultures. In the past twenty five years since these technologies were first taken up in schools we have witnessed huge changes in the distribution of wealth, the creation
and loss of employment and the production and distribution of various forms of entertainment. Despite these changes, the practices of schooling have remained largely unchanged. Schools, in this respect, have proven to be remarkably resilient to the changes that have developed in almost all other social institutions.

What I want to do first in this paper is map the patterns of interaction between schools and computing and related technologies. I suggest that these patterns were, perhaps presciently, described in the satire, *The Saber-Tooth Curriculum* (Benjamin, 1939). Benjamin’s narrative tells the story of a Neolithic schooling system based upon skills appropriate to an environment in which fish-grabbing with the bare-hands, woolly-horse clubbing, and saber-tooth tiger scaring were useful and practical in the environment of the time. A large and, to some, a system reminiscent of today’s systems of schools, teachers and teacher education, emerged. It proved highly popular and became so much a part of that community’s culture that when conditions changed and fish could not be seen, the horses moved away and the tigers died out, the importance of the “basics” was only reaffirmed, even though they now had no value in terms of the circumstances in which the community lived. Attempts to reform the curriculum were met with arguments about over-crowding, faddism and protection of the cultural values embedded with the now redundant knowledge and skills set.

The emergence of microcomputers in the late 1970’s can be argued to mark the beginning of a new and different sociotechnical context for schooling, something I have, borrowing from Benjamin, playfully labelled cyber-toothed education. While perhaps not quite as fearsome as a tiger and certainly not as edible as the fish in Benjamin’s scenario, the micro prompted a significant shift in resources and policies for schools in order to deal with what was variously represented as challenge, aid and threat. Computer literacy courses were developed at a number of levels in schools. Teachers’ Colleges and Education Faculties developed post-graduate courses concerned with ‘computers in education’ and governments and schools developed policies that aimed to support and encourage computer use in classrooms. In this period, issues of integration of computers into classroom practice, teacher professional development and access and equity were important (Bigum, 1987). In many respects, schooling had to respond to what was clearly something that was unlikely to go away. The responses had to convey what schooling had always been about, certainty. So even though the outcomes from the deployment of these new technologies would prove to be unpredictable in many spheres (see for example, Strassman, 1997), schools were certain about what they were doing and why: the threat of the cyber-toothed artifacts was seen to be met.

A similar certainty could be found in tertiary computers in education courses. The uncertainty of these technologies in education settings was quickly rendered certain and assured. These technologies were just another medium, like other media previously studied and researched in education. School went on much as it always had. The strange technologies were no longer strange. Journals published research concerned with learning and computers, classrooms and computers, computers in education generally. Annual national and international conferences were held. Various professional associations to cater for teacher and researcher interest in computer use in education sprang up. From these foundations it then became possible for schools and teacher education to respond quickly and efficiently to each new cyber-toothed artifact that industry produced over the subsequent twenty five years.

As part of tracing the build up of a large responsive infrastructure around computing and related technologies in education, I want to establish an approach to thinking about technology generally to help further unpack the problems associated with what I have dubbed cyber-tooth policy and its associated thinking.

**The T word**

In tracing the history of computing and related technologies in education, a key consideration is how technologies are understood. Commonly, technologies that are labelled new are thought about as artifacts or objects although clearly things like gene manipulation technologies are better described as processes. Ursula Franklin argues that technology is best thought about as practice, formalised practice (Franklin, 1990, p. 15), or perhaps more colloquially, the way things are done around here. Franklin’s framing confirms the importance of thinking about the social together with the technical, the language bearers with the non-language bearers. This approach is not far removed from the work of scholars like Bruno Latour, John Law, Annemarie Mol and others whose work is underpinned by an approach in which the social and
the technical is rejected in favour of the sociotechnical, a view in which the social/technical binary is something to be explained rather than a given. There are various related forms of this approach to theorising technology that can be found in the cyborg literature, the work of Katherine Hayles, Donna Haraway and many others.

With this in mind it is useful to recall that when new ways of doing things are introduced into various settings that the first attempts at making sense of the new is to read it in terms of older, more familiar technologies. In retrospect, these understandings appear quaint, even humorous (Marvin, 1988). The automobile when it was first used was written about as a horseless carriage. The first motion pictures were made by photographing actors on a stage. It takes time, and for many technologies a great deal of time for mature or what might be regarded as sophisticated forms of practice to emerge.

A further point to make about computing and related technologies in particular was made by John Perry Barlow in an interview he gave during a visit to Australia (Tunbridge, 1995). He illustrated the difficulty of extrapolating the logic of atom-space into bit-space (Tunbridge, 1995, pp. 3-4):

> When I first looked at this stuff I thought, 'Hey, great. I can get out of the cattle business and still stay in this nice place, Pinedale, Wyoming and let my mind roam the planet; just put my body down in this location and my mind will travel.' What's actually happened is that I put my mind down in one location, Barlow.eff.org, and my body roams the planet, precisely the opposite of what I expected.

He continues:

> See, the problem there is, nobody really understands networked economy, but I can tell you up front that practically all of our systems and paradigms are not going to work there -- in fact, they're turned completely on their head. The basic one, of controlled economics in the physical world, is that you regulate scarcity to increase value. This works with physical goods. That's how the De Beers corporation makes its living. It's not that diamonds are rare, it's that De Beers owns all of them. That's the classic example, but precisely the opposite is true of most information. With information, familiarity has value, not scarcity. It's dispersion that has the value, and it's not a commodity, it's a relationship and as in any relationship, the more that's going back and forth the higher value the relationship. People don't get this if they're coming from the industrial-era model. If all you've got is a hammer then everything looks like a nail. (Tunbridge, 1995, pp. 3-4)

**Maintaining an illusion of certainty**

There are many instances in which strong cases can be made that when a new technology is deployed that things change and often in ways that are far from being predictable (see, for example, Tenner, 1996). Such outcomes are to be expected from a sociotechnical point of view in which the recruitment of allies to form durable networks of people and things is something that requires compromise, translation and constant policing (Bigum, 2000; Bigum & Rowan, 2004). However, in order to justify the deployment of a new technology, one usually has to make a case that said technology will improve things. Lee Sproull and Sarah Kiesler (1991, p. 4) describe such claims about improvements as ‘first level effects’, which they describe as ‘the planned efficiency gains or productivity gains that justify an investment in new technology’. When the new technology is put in place, what happens often bears little relationship to what was imagined to happen, Sproull and Kiesler call these ‘second level effects’, ‘...people pay attention to different things, have contact with different people, and depend on one another differently” (Sproull and Kiesler 1991, p. 4).

It is against these considerations of technology as formalised practice, of early representations of new technologies and of the claims made to justify expenditure on new technologies that the twenty five year history of using computing and communication technologies (CCTs) in education needs to be viewed. It is a history of large expenditure, ongoing certainty and a strong focus on CCTs as such. What I want to suggest is that the initial thinking and policy responses have changed little from the early days when, arguably, they made sense given the novelty of CCTs and the many explorations concerned with support of teaching and learning. But the cyber-tooth mindset has persisted for over two decades now and shows little sign of changing. Indeed, the use of terms like “learning technologies” to describe computers while
qualifying for what McDermott identified aswishful namingmany years ago, reinforces a set ofbeliefs andpractices firmly grounded in assumptions aboutCCTsand learning that are impossible to demonstrate. Inwhat follows, I want to illustrate two types of consequences from the cyber-tooth mindset.

**Having answers**

One of the earliest responses schools made to the appearance of commercially affordable microcomputerswas to put computer literacy classes in place and affirm the importance of all students becoming computerliterate. This is a good instance of enacting certainty in relation to the uncertainty that these early computersgenerated. While what was done and claimed on behalf of such literacy does not bear close scrutiny, theimportance of having a response to what had been affirmed as something of a crisis: students did not knowhow to use computers, was important. More broadly, the same can be said of having CCTs in schools. The rhetoričof the computer industry had positioned these new technologies as improvers of student learning andimprovers of student life chances (Bigum, 1998). It was difficult for any school to resist taking themup. Having positioned themselves in this pattern of crisis and quick response, that is computer-based crisisrequiring some kind of educational response, it became increasingly difficult for schools to respond indifferent ways. The rehearsal of this pattern, enacting certainty, is at the heart of the cyber-tooth mindset.

The emergence of the Internet afforded more crises. The ready availability of pornography, and to a lesserextent gambling and hate sites posed problems for schools that gave students access to the Internet. The response was to deploy software that would limit or block student access to such sites. Leaving aside the technical limitations and stupidity of this response, the opportunity to develop an educative approachtos these problems was largely lost. A quick, technical fix was something that could be explained to parentsmore easily than a more complex and slower educative program.

Another crisis that quickly came to the fore was the realisation that the Internet offered more and more dataabout more and more of the world. The problem that all students encounter when faced with multiple sources of data about a particular issue was multiplied many times. Prior to the Internet becoming thesource of data it has become, there were practices in schools which taught students how to judge conflictingclaims to truth. These were based on well established practices associated with print and to a lesser extentother media. In a more or less linear move from atom-space to bit-space, information literacy emerged as the solution to the crisis in Internet-based information. Like other responses, this solution relied on the assumption that bit-space is not very different to the familiar atom-space, in this case the assumption that the ‘infosphere’ is amenable to the kinds of search and enquiry methods that have been used in the past for books and for structured or ordered collections of data (e.g., Morgan & Batovsky, 1998).

There are many other examples to be offered that reflect the certainty that was first realised when schools,teachers and teacher educators constructed those first educational responses to the “crises” that wereassociated with the deployment of the early microcomputers. But there is a more serious consequence ofcyber-tooth policies and thinking.

**Fiddling while Rome burns**

The focus on CCTsand the belief in a capacity to respond educationally to virtually any panic or problemthat might emerge as new CCTs come onto the market has produced a highly localised view of therelationship between CCTsand various educational practices. Like Benjamin’s Neolithic hunters thepreoccupation with having plausible educational responses has not allowed any consideration of thechanged circumstances in which schools, teachers and teacher educators now find themselves. Unlike theearly 1980’s, schools are not richer in computers than their local communities. Unlike the early 1980’s,some students are likely to be more technically skilled than the adults who teach them. Unlike the early1980’s the global deployment of CCTs has resulted in very large changes to the economic, social andcultural lives of many people on the planet. These changes are well documented and theorised in a largeliterature that is concerned with the phenomenon commonly referred to as globalisation. The globalphenomena with which we have become increasingly familiar would not exist without CCTs.

While there is recent evidence that school systems in Australia have begun to rethink curriculum in thelight of some of these changes, the cyber-tooth mindset remains in tact. The solution it seems is to rework
and restructure curriculum but to leave the approach to CCTs more or less unchanged. To help students come to terms with these new times (Kenway, Bigum & Fitzclarence, 1995), it seems, is a matter of continuing the cyber-tooth practices that had their origins in the early 1980’s, that is to work to integrate CCTs into the curriculum, to continue to address each new panic that accompanies each new CCT and to maintain the certainty that has characterised cyber-tooth policies for over twenty years. It is not unlike what Kling (1996) has described as heads-in rather than heads-up thinking. While I don’t want to suggest that some technical capacities in working with CCTs ought to be a necessary component of most students education at school and in further education, such skills in the absence of a broader appreciation of the use of these technologies to powerfully shape the social, economic and cultural spheres is as meaningful as the teaching of fish-grabbing with the bare-hands, woolly-horse clubbing, and saber-tooth tiger scaring after the external environment in Benjamin’s satire had made each skill redundant. The problem of cyber-tooth thinking is that it effectively engenders a complacency. There is no crisis for which we can’t construct a workable educational solution.

I want to briefly explore a future scenario to further illustrate the problems we face. It is generally anticipated that Moore’s Law will continue to work for a few more decades yet. By roughly 2020 processors will be able to carry out as many calculations per second as the human brain. While I am unpersuaded about the emergence of some superior cybernetic intelligence, I am more concerned about how this might play out in the field of robotics. The two major problems robots have at present are speech recognition and vision. It is not unreasonable to assume that even if there are not elegant solutions to these problems by 2020 that the sheer capacity of microprocessors will enable a kludge or inelegant solution to give robots these two capacities. Such advances will render virtually all of the current so-called service jobs susceptible to replacement by machine. From house cleaning, to fast food, to retail, robots will have the capacity to do the work. The irony of this is that these are the very jobs that this current wave of computer deployment has produced. Even if this scenario only plays out partially, it means unemployment or under employment for a very large section of the community. The teachers currently being trained will teach students who will grow up in such a world. The place that CCTs currently enjoy in teacher training continue to mirror that which is found in schools. It is cyber-tooth thinking.

**Ways forward**

The characteristic of cyber-tooth policies and thinking is that of certainty. In a world which has now become dangerously uncertain this predisposition is not only foolish, it is dangerous. Schools, schooling and teacher education need a framing that reflects these circumstances. This, to me, means a number of things: a rethink of schooling and by implication teacher education which is linked to a rethink of curriculum. Instead of a predominance of certainty, of answers, there needs to be a prominence of questions. It is not difficult to imagine curriculum informed by such thinking. Indeed there are instances of such approaches, e.g. the International Baccalaureate.

The current period in education is characterised by considerable interest in curriculum. In most states and overseas there appears to be an unease about the suitability of current curriculum for preparing the young for a world that is much changed from the period when most contemporary curricula were developed. New curriculum initiatives can be found in many states. Debates that figures in these initiatives ask questions such as: what is worth knowing, what are ‘essential’ or ‘basic’ knowledges, and should there be more emphasis on process or content?

For education curriculum/policy makers, contemporary CCT-based resources such as the Internet appear to place an emphasis on knowledge (as per the knowledge economy) which subsequently slides into debates about content, i.e. curriculum is about content, and, more often than not, its consumption. Importantly, the social character of knowledge is largely ignored. The irony of schooling systems which place an emphasis on the consumption of various forms of knowledge at a time when the production and leveraging of knowledge and research skills are prized, appears lost in the current debates.

One view of curriculum is that it is the stories the elders of the tribe tell the young. I want to suggest that increasingly these stories, in this era, are less narratives and more questions, i.e. how should we live in the world? what does it mean to be an Australian? how do we relate to our geographical neighbours? how do we understand global phenomena such as finance, terrorism and entertainment?
As a way out of the problem of deciding in advance what is appropriate content to equip students to participate as active citizens, we might think about curriculum in terms of questions. Importantly, this device might be used to engage the Australian community in contributing to the construction of a set of questions. One way to operationalise this notion would be to poll a large subset of Australians to nominate, say 5 or 6 questions that they believe to be important to Australia now and in the future. A variety of events, protocols might be employed to arrive at a set of national questions, which would be the basis for curriculum across the country. The process might be repeated at regular intervals (3-5 years) to reconsider the question set.

How would the questions frame curriculum? Nationally they would constitute a statement of our priorities. Things that need to be investigated and thought about. A question, unlike a lot of content, can be contextualised at a national, state and local levels. This then would be the curriculum. Engaging the young and their communities in a set of national questions, locally nuanced, that have arisen after a process of debate and contestation would require them to engage in knowledge production/leveraging and research. It would mark the country with a curriculum that looks forward in a more pragmatic and potentially effective manner compared with current content-focussed thinking.

The same research/enquiring approach also can inform the way school and teacher education is done. In such approaches CCTs are not a focus. They can be used to do useful work where appropriate. Instead of doing pretend activities in a safe environment as is the case with current curricula, students are engaged in asking better questions, that is doing research, on issues that are valued by local constituencies such as schools in the case of student teachers or the local community in the case of students at school. There are a number of experiments of this kind currently being conducted in various parts of the world. A small project in which I have been involved and dubbed knowledge producing schools is working in this direction (see http://www.deakin.edu.au/education/lit/kps and another paper presented at this conference). Teacher education, in this analysis, has a pivotal role in the professional regeneration and itself and schooling. It is only under these circumstances that new kinds of teaching and learning better framed to prepare students and teachers for a much changed world is possible. The choice is simple, cyber-tooth thinking around CCTs can be allowed to continue to thwart attempts to explore the broad range of issues and questions that characterize the world or we can begin to remake things in a manner that will genuinely support students and teachers to make sense of and act in these new, challenging times.

References
Comparing motion pictures made in the early 1920’s with those of today illustrates the point.

\(^{(ii)}\) I use the adjective computing in preference to information to avoid the connotation that it is information with which computers deal. Information is, as Bateson (1972, p. 453) reminds us, the difference that makes a difference, that is an attribute that is relational, not absolute. Computers, at base, do one thing, they compute.

\(^{(iii)}\) Assuming that censorship which is an atom-space practice could be migrated into bit-space underlines the naivety of this tactic.

\(^{(iv)}\) Floridi (1999) describes the infosphere as “the global macrocosm of services and documents, encoded in any semiotic and physical media, whose contents include any sort of data, information and knowledge...”