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*Leading technologies: a mid-term analysis of a longitudinal study into  
the integration of learning technologies in NSW public schools*

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**ABSTRACT** *The effects research project commenced in 2001 with funding from the Australian Research Council and the NSW Department of Education and Training. Members of the research team are pursuing a number of lines of interest in the field of computer-based learning (CBL) including: what do classrooms that integrate CBL look like; what are the effects of CBL; practices and trends in online projects; and how do different types of schools develop effective CBL practices? Our approach has been to identify a small number of schools that are actively attempting to integrate CBL. A key factor in choosing these schools has been the support and involvement of their principals. In this paper, we report on our interviews with these principals and discuss their leadership practices within the contexts of their diverse schools. An important feature of this research is its longitudinal component and this analysis is being undertaken just past the mid-way point in our study. Emerging themes reflect the complexity of leading the integration of educational technologies in schools and relate to infrastructure development, human resource development, curriculum design, pedagogical practices and futurist thinking.*

## **Introduction**

A recent study of the impact of research into information and communication technologies (ICT) in Australian schools attempted to determine the degree to which educators' engagement with new technologies was stimulated by research-based knowledge. This 'backtracking' approach concluded that 'school-based educators search for evidence about the effective use of new technologies in their own classrooms by observing their own students' (Figgis, 2000, p. 321). The report goes on to say that: 'Systematic research has not loomed large in backtracking ICT practice and policy. ...Educators believe that the research base on the most effective uses of computers and fundamental outcomes from using them is not robust enough to be helpful on a large scale' (p. 321). The effects research project responds to this claim on two fronts. Firstly, it focuses its interests alongside educators in classrooms. Secondly, it attempts to contribute to the robustness of systematic research into ICT by providing a small comparison study of a few carefully chosen schools over an extended period of time, thus contributing to a larger body of research by recognising that mixed methods of research serve complementary purposes (Darling-Hammond and Youngs, 2000).

We are also aware that research into ICT in schools is replete with tales of failure and claims that 'technologies by themselves have little scaleable or sustained impact on learning in schools' (Honey, McMillan, & Carrigg, 1999). Even in the very favourable location of Silicon Valley, Cuban's (2001) case study of two schools found that, notwithstanding a climate of rhetoric to the contrary, new technologies were hardly being used at all. Within this context, we set out to examine the work being undertaken to integrate ICT by conducting a longitudinal study drawing mainly upon interview techniques and classroom observations. We have looked for evidence of the effective use of new technologies in classrooms by observing teachers and describing the contexts in which they are operating.

In education, as in other areas of research into new technologies, there has been an emphasis on the technologies themselves and their perceived potential to transform our

experiences. However, as Lucy Suchman (Benjamin Franklin Medallist in Computer and Cognitive Science) argues, ‘you have to look at [technology] in the context of its everyday use...and to value the less glamorous, but more foundational, aspects of technology development...really attending to the kind of background design that makes all of the flashy stuffy actually work’ (Foresheew, 2003, p.33). Hence, a key purpose of our research is to examine the foundational aspects of technology use in schools and to attend to background designs. As the name of our project suggests, we are interested in the effects of technology integration in schools and we acknowledge that, currently, enhanced learning opportunities are not generally an effect of such integration. This is not to deny that technology integration *is* having an impact on schooling but that its effects are generally not well documented, or understood, and are sometimes unanticipated.

In this paper, we compare these effects in three secondary schools and two primary schools in Sydney. They are all government schools but located in a mix of communities representing inner city, suburban and fringe locations. Two secondary schools are comprehensive in nature serving mainly low-income families; one has number of Indigenous students and the other has a high proportion of students newly arrived in Australia who predominantly speak languages other than English. The other secondary school is selective and caters only for girls. One of the primary schools is in an established outer suburb with a high proportion of middle-income families, whereas the other is on Sydney’s urban fringe with a large number of low-income families. All the schools were selected because they had a reputation for innovative practice in technology but none have received additional or targeted funding for technology or equity programs. We are now in the second half of this three-year study and this paper reports on emerging trends in our ongoing analysis.

### **Background design issues**

Our interviews with principals have been wide-ranging and for the most part unstructured. We have encouraged them to tell us the story of technology integration in their schools. These

interviews were taped, transcribed and sections considered for publication were returned to the principals for approval and comment. As themes started to emerge, they were used to shape further conversations whilst we also attempted to stay attuned to new issues. Our sustained contact with the schools enabled us to track some issues as they were evolving.

The task of integrating technology into schools requires highly developed project management skills. The three secondary principals in our study had been responsible for this process from its very early stages and they had all established local area networks and managed the required structural modifications of their schools, such as laying cables. Each spoke of at least one key colleague who had supported them, who had vision and who had the requisite knowledge to support this process. Initially at Girls High, this person was a casual computer coordinator and getting him appointed to the school fulltime was a long term and time consuming project in itself. All three principals spoke of taking considerable risks in the early stages. These included exposing the school to financial risks and also risking their reputations on untried solutions. Julia, the principal of Girls High, related how they went about networking the school.

We called in five firms and I sat and talked to them about what I'd like to see, wonderful things that now actually happen. They all suggested Novel, except one that came up with Windows NT, but it was new. Now I've never really liked to be the first up, I always like to be second. I'm an athlete and my coach always said, take them in the straight, so I'm not really into risk taking. And, when I raised it with the Department, I got no support whatsoever because all the people in technology were the Oasis people at that stage, and so they really said you're doomed. And we were. We were outcasts for quite a long time.

However, Julia's risk taking paid-off because the school now has a stable and reliable network. Setting up and maintaining such systems was a core and ongoing concern for all the principals. However, stability once achieved is not guaranteed as networks expand and are modified. In the case of Suburban High, the school's networking requirements grew beyond the capabilities of available technology and expertise. During our first visit, the school's network was 'humming', but when we returned a few months later, the school was 'marking time' waiting for the

technology to catch up with their design needs. Helen, the principal, explained the set of difficulties the school was experiencing.

Since we last spoke, a huge amount has been happening in the hardware connectivity area...it's just been change overload, system overload and software let down and...people have just thought, oh, it's just too hard. So, I'm downplaying initiating more change until the system changes. We're a sort of flagship school that runs Apple and some PCs, so we're this dual platform school, and it was hoped that we would be the model for the state. Now, that meant a huge amount of work on the computer server. It meant all this stuff happening with network hubs and servers and proxy servers and – this is very complicated and I'm making it appear simple, but it wasn't – we had to do a whole range of different things. We had to have different ghosted images for setting up computers and it became quite a nightmare. And we had the top technician from Apple working quite exclusively with us. We had someone from the Department who was the Microsoft expert working with us really totally. And they wanted to try out how we would work on OS10, the new operating system in Apple. And so we said, sure, we'll do it...but we now realise that OS10 has bugs. And they are working to get all the bugs ironed out...but there are problems that we can't solve and that are just cropping up and we're just stuck with things that don't work. So we're in a really difficult state. Because we've gone too far down the track, we can't do anything about it, and we're a bit stuck. So we are just plodding on and a lot of things are working, but there are these issues that are beyond us to solve, so we just have to just say, steady as we go. So that's why I'm not pushing – we can't even do major training on technology until we're really confident that it's working.

Despite the difficulties Suburban High was experiencing, Helen was confident that this problem, like many others before it would be fixed. This confidence grew from having built the system from scratch and having maintained a hands-on feel for the technical details. However, the situation was quite different for one of the primary principals who had been newly appointed to his school. He inherited technological and operational systems that were largely unknown to him and in varying states of functionality. When we first visited Fringe Primary School, Tim, the principal, had taken up his position six weeks earlier. In our interview with him the following year, he outlined some of the issues he had faced when he first came to the school:

We had a library with twelve PCs, that were different from every other classroom in the school. So, in any professional development session that we did, the staff would say, but I don't know how to use the Macs in the classroom...we had three or four different word processing programmes out around the school...The computer network never worked when they wanted it to work, they couldn't get on to the internet, they couldn't use the programmes they wanted because the system wouldn't allow them to.

Whilst structural and networking issues were central to what Tim was hoping to achieve, they were only part of the complex spectrum of background design issues, and these extended beyond technology. Tim also noted that:

There is no talk about core beliefs and values. There's no talk about learning styles, there is no talk about grouping, there is no talk about some of the achievements that have happened in the classroom, so I'm assuming that the focus has been on... what I would call school based structures, rather than teaching and learning structures. Policy development, procedures, a lot of those strategies have been put in place but the focus hasn't been on teaching and learning, from what I can see, at this point of time.

Tim consistently articulated a clear vision for learning at Fringe Primary School, and technology was part of this vision. Achieving this vision required establishing and maintaining reliable and accessible technology *and* building the capacity of teachers to integrate technology into meaningful and well-designed learning programs. Both primary and secondary principals identified these dual but aligned concerns. When we first spoke with Amanda, the principal of Western High, the school was attempting to introduce wireless networking in order to overcome the need to lay cables in every building. In bringing us up to date on this issue during our second visit, she stated:

We want to get the hardware and software questions out of the way, because I don't think they're the main game but there is no doubt that there are some really important structural barriers... I think we've still got basically a telephone line modem for our thousand kids and we knew several years ago, we needed more. The structural things are certainly getting in the way of us taking the next step...I'm pleased with where we've come to, but it's not as far as I thought we

would have come when we spoke last year... I wouldn't want you to think that I was just having a whinge about bandwidth, cause I think you could get stuck there. It's far more complex. It's about the curriculum and mandated hours; it's around issues to do with secondary school timetables and staffing, and so on.

The principal of the other primary school in our study also included parents within the scope of what the school was trying to achieve through technology. Paul explained that the parents in the school asked if he could run a training program for them.

We designed a training course for parents over three nights, where we actually take them through the basics of what the kids learn, what the kids are doing with technology in the classroom and what they can you do at home to support them.

These issues combine to make the process of integrating technology in schools complex, difficult to contain and hard to predict. As we returned during the course of this study and the scale of background design issues unfolded, we began to understand why ICT has had such little widespread impact on enhancing learning opportunities in schools. Schooling is essentially a modernist project and there is nothing intrinsic about computer-based technology that will challenge or change this project. Indeed, we have observed many dusty unused computers lined up in classrooms, but the principals in our study were determined to find meaningful ways of integrating ICT. They all indicated that at some time during the process they had to 'make the hard decisions' and push ahead in a particular direction with well-considered but basically unproven approaches. In the early stages, Amanda observed that she had to be 'immovable' on some issues. In relation to making computer studies mandatory for all students she said:

People were worried, oh we can't fit all the kids in; not all of them will be interested. But I was just immovable. And I decided it was a hill worth dying on. Because we couldn't wait. I couldn't have only twenty kids in every year going through having computing studies when I could see what was happening realistically in the world...So it was about addressing a whole lot of stuff, it was about the gender stuff, about the fact that Aboriginal kids wouldn't choose it, so we made them, those kinds of things. And it was about me pushing what was important.



Identifying what was important in a sea of hyper-expectation about the role of ICT in the classroom was an ongoing issue for the principals in our study. They each resolved this in highly contextualised ways because there was limited system wide experience and few mechanisms for sharing what experience existed. Even so, there were some common elements to solutions and approaches they were adopting. Both Girls High and Western High had adopted the International Computer Drivers Licence course as part of their curriculum and were expecting it to be completed in earlier years. This self-paced online resource filled a gap in curriculum resources resulting from prolonged silences in NSW syllabus documents about ICT. These silences delegitimised the significance of ICT and withheld points of leverage for change in schools. They also reflect a widespread uncertainty about how to integrate learning technologies. Western High was planning to take up these matters through its curriculum planning process. Amanda explained their plans in the following way:

What we're hoping to do next year is to actually map the junior curriculum. So to take each subject, seven to ten, and say, okay, what are the skills that you would need and technology will be one of them, what are the technological skills, in this subject, you would need to be able to display by the end of year seven, by the end of year eight, year nine, year ten. We're hoping that by mapping curriculum and linking it to the reporting, we'll actually then be able to put the two middle bits in, teaching and learning, effective teaching and learning activities and appropriate assessment of those activities. So that's the plan.

This process of mapping technology across the curriculum was a strategy for leveraging support for CBL by aligning it with assessment and pedagogy. It was intended to make meaning of CBL within the existing operational practices of a school. We also observed the reverse - technology being utilised as a catalyst for changing existing practices. Tim compared using technology as a catalyst for change to other types of catalysts:

I believe that you've got to have catalysts for change. And you could take teaching styles as a catalyst for change, you could take an outcomes approach to education as a catalyst for change. I see technology as a catalyst of change here because the kids have so little hands-on experience with it in the classroom situation as a tool for

learning. And that's what I think is its strength - something that you can use to create learning opportunities that the kids don't necessarily get on a day-to-day basis.

None of the principals claimed to have made significant progress in embedding technology beyond the compulsory subjects but all were working strategically to achieve this within the limits of their resources. The depth of these resources varied greatly (c.f., Audit Office, 2000) and their scope included hardware, software and various trained personnel. Julia related how she reconceptualised the role of one of the school's non-teaching staff to support this process.

I took one of the teaching assistants that used to cut up onions and things in the kitchen and appointed her as a technical assistant. Now she goes around and looks after all the workstations. But not everyone can adjust to such a change in duties. Sometimes you've got to wait until you have a change of staff and then you can slot the right kind of person in who's willing to be a technician. And I had to work with the union on changing her duty statement...

This story further illustrates the range of background design issues in schools related to the integration of CBL and, yet, we have hardly touched on issues related to classroom practices. Echoing earlier words, the background design makes all the flashy stuff work. Given the multiplicity, complexity and difficulty of implementing such designs, it is hardly surprising that our classrooms observations generally reflected previous research findings - new technologies are hardly being used at all.

### **CBL in the classroom**

We acknowledge that non-adoption of CBL may reflect informed decisions rather than diffusion failure, and that these decisions may vary from subject to subject. Amanda related the case of her English faculty who she described as, 'very highly skilled users of computer technology', but who nonetheless were unlikely to use CBL to teach skills that could be adequately, or more effectively taught with simpler forms of technology, such as pen and paper.

The fact that you can put your essay in MSWord and be able to format it is really a relatively low level skill to English teachers. The important skills to them are

generally not related to the use of the technology; the important skills are critical literacies in processing information, writing and interpreting different types of texts.

There was general agreement that the curriculum in some subjects lends itself to technology uptake by teachers; graphic design, multimedia and technology related subjects were often cited. This did not simply reflect the nature of the content but the degree to which curriculum documents integrated technology and identified appropriate outcomes. Amanda also acknowledged, that accomplished teachers have greater potential than less accomplished teachers to integrate technology in effective ways. She suggested that this had parallels in other types of integration issues such as literacy and numeracy strategies:

We've integrated a lot of literacy strategies across the curriculum in high schools in the last five or six years. And often it's been quite explicit. But in my opinion, it's rarely been effectively integrated. And that's what to me sets aside the accomplished teacher from other teachers. When you go to see a beginning teacher's lesson, they're likely to do a literacy activity. Accomplished teachers will do a learning activity that's embedded in literacy. And so, my view around technology's the same. The teachers who are comfortable and accomplished, whether they're technology trained or not, will integrate it into a meaningful learning activity.

One factor that is likely to distinguish accomplished teachers is that they draw upon a rich repertoire of practise. This relates to their pedagogical skills, as demonstrated through the learning activities they design, and through the structure of the organisational practices they adopt. At each school we encountered at least one example of an accomplished teacher who had achieved what their peers considered to be out-of-the-ordinary learning opportunities for students with learning technologies. Amanda described one such teacher at her school:

Jennifer's self-taught. Her supervisors would describe her as innovative. She has energy to burn. She's a remarkable young woman. She's highly organised and flexible. She volunteered to be part of an online learning trial but they couldn't get a stable line happening, it just kept dropping out. So, Jennifer ended up getting the students in her group for the trial to do it at home. So they agreed, they did three nights a week for two hours, seven o'clock to nine o'clock for the trial, and they really enjoyed it. Loved it. But they did it all at home. Now there were two students

who didn't have computers at home. On at least two of the occasions Jennifer went round and got them and took them to her place. Or they came here and worked from here...Jennifer had to learn to use Blackboard. Which she did - very quickly. She then had to be prepared to trouble shoot when things didn't work...integration of technology really depends on the staff and their skills – but it's not just skills, it's more – there are some personal qualities that seem to make people more successful.

The combination of personal qualities with pedagogical skills was also emphasised by Tim who claimed that student-centred organisational practices are more likely to facilitate greater technology diffusion and adoption than teacher-centred approaches. The rationale behind this claim is straightforward: if the teacher is guiding the classroom activities and the teacher does not use technology then the students will not encounter technology in the classroom. Tim described how he is implementing a team teaching model to facilitate the development of teachers pedagogical skills whilst taking into account their personal qualities and background experiences:

If we're going to make a change, technology is the change, but the teaching and learning must be put in place for cooperative learning to happen, so that each child has a role, that they're in cooperative learning groups or interest groups or graded groups or family groups or whatever grouping that you want across a stage or within the class. I think we have to give teachers that structure and that support in a team teaching model with somebody who knows the technology, because their biggest fear is that they don't want to touch the technology because they don't know how to use it and it takes a long time for that to happen.

This professional development model was designed to address the specific needs of teachers at Fringe Primary School. We noticed that these needs varied from school-to-school and included a range of pedagogical, professional and personal needs. For example, Julia noted that teachers integrating technology needed to rethink issues of control in the classroom.

You have to learn to let go and recognise that the students can and will pick it up; you have to be prepared to learn together. And that's threatening for some people who've been the font of everything, who've always been the provider of information. And, you know good teachers have got to know their stuff. But, they also can say,

well, I'm not sure about that. So, if they learn to let go, they can say, well, I don't know that, let's use the computer. The computers are around to check on things.

We could interpret this as simply computers having some parallels with encyclopaedia's and other authoritative toms, but on another level, it recognises that computers may be connected to global flows of knowledge and knowledge construction. Hence, as well as reflecting a shift away from the teacher as the locus of control and authority in the classroom, it reflects a shift in how we understand knowledge and its construction. The longitudinal nature of this study allowed us to track shifts in how the principals were thinking about knowledge, authority and the purposes of schooling. Amanda described some of the ways in which Western High was reconceptualizing core understandings of technology and its place in learning.

We have shifted our focus. Originally, in our values platform, that was developed in 1997, which is based around our school motto – Persist – the [T] value was around technology, that every student would have technology skills by the time they leave the school. This year we've been reviewing the values platform and we've had a really interesting conversation about whether we need to do that. Whether technology of itself is still as important as it was and whether there are other skills, which the staff have loosely called skills for towards tomorrow, future skills that students need, which will include technology. Which I think shows a significant sea change in teaching thinking. We're thinking about skills like teamwork, thinking about skills like consensus getting, thinking about skills like networking and all the other skills that are in our competency statements.

These shifts reflect how technology integration can trigger a broad-based reassessment of the purposes of schooling. It is a form of futures oriented analysis that is grounded in the reality of schooling and an understanding of the changing nature of work, social formations and global economies. Whilst schools maintain essentially modernist forms, they may also be dynamic interfaces between local conditions and global flows.

## **Conclusion**

Our study has exposed some of the background design issues that principals are facing at the turn of the century as they attempt to integrate CBL into their schools. As the complexity of these issues has unfolded, we have come to understand why the integration of CBL is most often reported as having no significant impact in schools. At the same time, we have become more attuned to the impact that technology is having in some schools with determined, lateral thinking principals who maintain a hands-on approach to integrating CBL within meaningful learning programs. Studying the process of leading technologies in a small number of schools over an extended period of time has enabled us to track shifts in strategies, thinking and outcomes that were sometimes unplanned and occasionally unwelcomed but always about more than just technology.

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