

IcT's About Learning:

School leadership and the effective
integration of information and
communications technology

Understanding that ICT is not just another passing fad
or innovation that might or might not affect our schools,
and being able to change the way the institution works
accordingly, is perhaps one of the most important requisites
for school leaders today

Ken Walsh, NCSL Research Associate, Headteacher of
King Edward VII School, Melton Mowbray



ICT's about Learning: School leadership and the effective integration information and communications technology

1.	Introduction	p3
2.	The Context	p3
3.	The Effective Integration of ICT	p4
4.	Leading Learning	p5
5.	The Principals' Attitude to ICT	p6
6.	Leading ICT from the Middle	p8
7.	Leadership from Non-Teaching Staff	p10
8.	An Intranet for Learning	p11
9.	The Changing Relationship Between the School and its Community	p13
10.	The Laptop Experience	p15
11.	Staff Training	p16
12.	Integrating ICT into School Administration	p18
13.	Budgeting for ICT	p19
14.	Governments and ICT	p20
15.	Lessons to be Learned	p23
16.	Methodology	p25
17.	Acknowledgements	p25
18.	References	p26

1. Introduction

This study is based upon findings from interviews with school principals and others in leadership roles in four UK secondary schools, three in Victoria, Australia and two in Singapore. School leadership has had to change radically in recent years, not only to cope with increasing accountability for raising standards, but also in the context of a society permeated by the impact of ICT. In the UK headteachers are being exhorted by the government to include ICT as a major element in the curriculum and in the day-to-day organisation of schools. There has been a massive investment in the training of teachers in ICT but the training of headteachers in this area has not so far featured in the government's strategy. At the same time, however, the government has firmly stated that strong leadership of schools is the key to the future success of education in this country and has invested heavily in leadership skill programmes for both new and experienced heads. Both NCSL and Becta are now looking towards filling the gap in the training of headteachers in the leadership implications of ICT.

2. The Context

“One of the perennial problems in the area of technological change in schools is the understandable temptation to write about the future before we fully understand the present.”
(Abbott, 2001)

Accepting the inescapable impact of ICT on our lives, education and work, it is vitally important that school leaders gain an understanding of what steps to take in their particular situation and for their own schools to make valuable use of the technology for learning. For this they will need to understand the bigger picture, and a vision of the future of learning transformed by ICT. They will also need to understand what skills are needed to make the crucial decisions concerning the changed priorities of school budgeting and staffing, which are consequent upon the process of integrating ICT into student learning.

Two recent surveys (Besa, Nov 2001 and Becta ImpaCT2, Nov 2001) point out the very mixed, if not confused, state of development of ICT in UK schools. The figures might dazzle, showing a considerable expense on installing hardware over the past three years but there are serious issues concerning the actual use made of the technology by students and the lack of progress towards integrating ICT into subject teaching. In September 2001:

- There were over one million desktop computers in UK schools (average 34 per school) but of these a quarter of a million were considered to be ineffective in teaching the curriculum because they were over five years old.
- The number of laptops had increased to 100,000 (average 4.4 per school) with 50 per cent being used for administrative purposes.
- Eight out of 10 schools had their computers networked, with 44 per cent of those making ‘significant’ use of internet connectivity, but 14 per cent did not use their networks for email or to share curriculum software.
- Thirty-five per cent of schools were considering wireless networking to allow laptop use in multiple locations, but few had taken this step.
- Most schools rely on ISDN access to the internet, and on average a school had enough bandwidth for just six concurrent users.

Pupils in the Becta survey reported that they spent up to four times as long using computers at home than at school and many expressed frustration with lack of access, speed of access and limitations of curriculum use in schools. Alongside this there was seen to be a growth in teacher competence and confidence, but ‘relatively few’ teachers were found to be integrating ICT into subject teaching in a way that ‘motivates pupils and enriches learning or stimulates higher-level thinking and reasoning.’

The rapid rise in computer availability in UK schools in recent years must nevertheless represent the fastest and most complete take-up of an entirely new technology in the history of education. However, in looking at the current situation, there is a lot yet to do before schools can realise the potential that this has unleashed. Abbott (2001) has pointed to serious flaws in the approach to teacher training in ICT: 'the kind of situation OFSTED might describe as adequate but with considerable room for improvement.' Teachers have been reluctant to take up the New Opportunities Fund (NOF) training due to its high demands on their own time and its inappropriateness for teachers who had not yet acquired basic skills (Becta, ImpaCT2).

This then, in summary, is where we were at the end of 2001.

3. The Effective Integration of ICT

The process of integrating ICT into a school involves a paradigm shift, where insights and new information facilitate new forms of understanding or an integration with earlier understandings to create new perspectives and interpretations. Integration implies an embedding of ICT in the school's structures and the organisation of learning.

"ICT systems can no longer be perceived as additionality or as enhancement – to be added to the concept of the physical or curriculum school design after the requirements stage."
(Richardson and Anstey, 2001)

All the study schools use ICT as part of the teaching repertoire in all subjects. Heads viewed the level of integration from 10 per cent to 80 per cent depending upon their perspective. In some cases they were thinking of daily, regular hardware use by students, in others, moving towards the development of an intranet that had the entire curriculum online and was available from home as well as anywhere in the school. For all, it meant a significant change in pedagogy, student assessment, and the whole administration of the school.

"ICT is effectively integrated when it is part of your lesson planning just as much as getting the textbooks out of the cupboard." (Sue Williamson, Monks' Dyke School)

"Effective integration means improving the quality of teaching and learning, not about teaching ICT skills." (Carol Webb, Cornwallis School)

"Effective integration can be tested in a given lesson if at least one of two things are taking place: a) by the end of the lesson students have further developed ICT capabilities; b) ICT makes something happen in learning about the subject that couldn't have happened, or couldn't have happened so effectively, otherwise." (Neil Calvert, George Spencer School)

"Effective integration occurs when every child has a guaranteed introduction to ICT in that subject and secondly where teachers are sharing what they are doing with ICT with other teachers." (Mike Woods, Cornwallis School)

"Every curriculum area's development plan has ICT objectives which link with the school development plan and ICT runs through the school plan like Blackpool does in rock!"
(Tom Clark, George Spencer School)

"Effective integration of ICT will have taken place when you use it all the time and nobody notices." (Colin Potts, Trinity Grammar School)

4. Leading Learning

The main change in pedagogy associated with the integration of ICT concerns putting the learning agenda firmly into the hands of the student.

“Technology is available to develop either independence and learning or bureaucracy and teaching.” (Illich, 1973)

All the principals interviewed were convinced of the value of integrating ICT into their schools because it had the potential to change the way students learn and to motivate them in their individual quest for lifelong learning. David Loader, now Principal of Wesley College, Melbourne, was probably the first principal in the world to realise the importance of individual access, a computer for every student. He was then Principal of the Methodist Ladies College in Melbourne, in 1990, when he instituted this policy. It is difficult to believe that over a decade ago students in one school took their laptops home as part of their normal way of learning and that these students were girls! From 1994 each student from Year 5 (year 6 in the UK) or higher and each staff member had a personal laptop computer. In his book, *The Inner Principal* (1997) Loader describes how he ‘stumbled’ across the personal computer as the logical conclusion to providing students with control of their own learning:

“At MLC our long-term goal is to place the responsibility for learning, and the choice of content, back on the student.” (Loader, 1997)

Seymour Papert was a major influence on David Loader's thinking. Papert (1993) describes the computer as a subversive element within a traditional school. David Loader (1997) describes how ‘monumental consequences’ flowed from the introduction of laptops:

“A school, its culture, curriculum and its teaching-learning paradigm began to be transformed ... computers are a transforming technology in that they make the student-centred model more accessible.”

School leaders should not underestimate the effects of integrating ICT into their schools. There is no turning back, the genie is out of the bottle, and everything from now on will be different, from class registration to class teaching, from setting homework, to exam preparation and assessment. ICT is not the icing on the cake, it is a vital ingredient – more like the yeast in the bread. Teacher-student relationships cannot be exactly the same again once the learner has control of the information.

“This is not just a change from inputs (teaching) to outputs in education (learning). Rather it is a paradigm shift in the conceptualisation of the school where everyone is a learner and even the organisation is allowed to make mistakes and be a learner.” (Loader, 1997)

For some principals who were educated before the advent of ICT this may be a difficult pill to swallow. For many, like David Loader, it is the medicine that will bring health back to the school and put learning as the central purpose and the leading of learning as the *raison d'être* of the principal. School leaders who have experienced the changes consequent upon ICT integration have realised that in some ways the initiation was the easy part. Change is a process, not an event, and too often the post-initiation ‘implementation dip’ acts as an inhibitor and can threaten morale.

Law and Glover (1998) define the requirements for effective implementation of change:

- clearly defined change management responsibilities
- the empowerment of individuals and the school as a whole, without top-down pressure
- both pressure and support
- adequate and sustained professional development support
- rewards (more than praise) for teachers in the early change process.

And ensuring that change is institutionalised requires:

- embedding the change in the school's organisation and structures
- eliminating practices which compete with or contradict change
- developing strong links with other change efforts
- spreading good practice and assisting those in need through local facilitators.

At King Edward VII School the vision for the impact of ICT on student-centred independent learning is articulated in the school by engaging staff across the curriculum in ongoing learning developments in their subjects. A number of staff are working with other teachers locally, nationally and internationally. An example of this is where the school's bid to the European Community led to a two-year project involving 12 teachers across four European countries in the creation of web-based learning resources for maths, science, IT and modern languages. The day-to-day management of the school is dependent upon ICT and all staff have laptops that have to be used at least for class registration, student grades and reporting.

“It would be incomprehensible to think of the day-to-day administration of the college not to be computer driven. ICT means a greater openness between subjects. Students generally find transferring skills between subjects difficult, but with ICT skills they find it easier and heads of department work co-operatively in ensuring that ICT skills are taught in the same way.”

(Paul Marsden, Monk's Dyke School)

Even at schools where integration of ICT is fairly advanced the principals and staff realise that there is still a long way to go.

“Nationally schools are at a stage of acquisition rather than pedagogy. Even schools at the cutting edge are still scratching the surface as regards pedagogy.”

(Tom Clark, George Spencer School).

5. The Principals' Attitude to ICT

In the schools visited the heads and deputies have all been willing to change the way they work both on an everyday basis and more fundamentally in the way that planning and long-term decisions are made. Heads did not have to have a detailed knowledge about the technology themselves but they had to have enough to know what they were talking about in dialogue with experts and enough to work with the technology themselves in their everyday working lives. It was clear from the interviews with principals and others in the schools that without a total commitment over time from the school leadership there was no way that ICT could be integrated into the life of the school.

All the principals interviewed had considerable experience in school leadership ranging from seven to 21 years. Their common experience was their growth as leaders and managers throughout the years of ICT impact on schools and on society in general, over the past decade, and in particular over the past five years. They also all started their teaching careers, and in some cases their headship careers, at a time when information technology had little impact on either school administration or teaching and learning. They are all self-taught enthusiasts and have become advocates of the importance of ICT in education based on their own experience and that of colleagues with whom they share this commitment. The principals had been responsible for driving the development of ICT in their schools in very individualistic and pioneering ways before any real lead had been given, or expectations set up, by the state. The experience of the four UK principals is representative of a significantly expanding minority of heads who are promoting the use of ICT in their schools and who have a lot of experience to offer to others who are at an earlier stage in its development. In Australia and Singapore principals have been part of a statewide commitment to ICT in education, which has been central to state policy in Victoria and Singapore over a period of years, but a great deal has depended upon the leadership of individual principals.

Email had transformed the way headteachers worked, the way in which they communicated with staff (especially on large school campuses) and the way they networked with colleagues in their own country and internationally. Sue Williamson at Monks Dyke checks her email three times a day. She is able to download her work at home and choose when and where she works. This has freed up valuable time to talk with staff face-to-face. In my own case, at King Edward VII, all staff have laptops and are on email. They know that if they email me, whether I am on site or not, that they will get a response very quickly and much quicker than calling in when I might be with somebody, arranging an appointment, or writing a paper memo. I banned paper memos two years ago and have worked more efficiently ever since.

My judgement is that standards of presentation from all senior team members and all staff at staff meetings have improved beyond measure in the past three years with the use of PowerPoint. No one would dream of using OHTs in a staff meeting. All staff and student bulletins are online. This is more efficient and has reduced the uses of paper and the printing bill.

Heads have learned the necessary skills associated with administration systems, including student data retrieval, financial and staff planning. Having immediate access to up to date data has made the job easier and has changed the secretarial function of the head's secretary or personal assistant.

Heads need to use ICT regularly in their daily work and to develop an interest in how systems work. They also need people they can rely on in their teams who have a more detailed knowledge of the software and hardware needs for both learning and administration. Without these people heads can make expensive mistakes. With ICT there is a lot of money at stake and the model in the UK is for heads to make crucial decisions themselves. Sometimes there does not seem to be much impartial advice. Keeping crucial members of the teams up to date with what is relevant to their area, be it administration or learning, is vital. When heads have to make major whole school budget decisions about systems and networks the heads interviewed stated categorically that the best advice would be from colleague heads. The pioneers have already made mistakes. Heads can and should learn from them.

One headteacher spoke about the importance of taking advice from teachers and other staff and of going out to speak with colleagues.

“Heads should go out for advice and gain confidence from other schools”
(Tom Clark, George Spencer School).

“The success of innovations is directly proportionate to the extent to which a significant shift in attitudes, perceptions, values and behaviours has been achieved. These in turn lead to a re-conceptualisation of the nature of roles, relative status, the allocation of resources, levels of authority and responsibility and in the final analysis, a re-appraisal of the core values and primary purpose of the school.” (West-Burnham and Bowring, 1999)

To understand that ICT is not another passing fad or innovation, which might or might not affect our schools, and to be able to change the way the institutions work accordingly, is perhaps one of the most important requisites for school leaders today. The principals and other school leaders interviewed emphasised both the importance of communicating the vision, and the skills development and involvement of all school teaching and non-teaching staff. They also pointed out the importance of leadership, not just from themselves, but also from a range of staff, not all of who might have come through the conventional career pathways.

6. Leading ICT from the Middle

All of the schools involved in the study had changed their management structures and leadership teams, not only to cope with the expansion of ICT, but also to involve a wider range of staff in the process of innovation and change. Typically structures were wider and flatter than the conventional hierarchies and leaders had been identified outside the line-management model. The schools do not have IT departments.

“One mistake you can make is not pushing ahead enough and the other is pushing too far ahead. We have to be careful that the senior team do not get ahead of the rest of the school.”
(David Loader, Wesley College)

“The first thing I tell people when I talk around the country about ICT is to get the nerds and their laboratories out of the system and hand the teaching and learning over to the educators.”
(Ken Rowe, Frankston High School)

Travis Smith, at Frankston School is in his fifth year of teaching and came to the school as a geography and psychology teacher. He has a cross-curricular role as Director of Computing, a third tier, senior position. As well as being responsible for the curriculum development of ICT across the school he has a responsibility, alongside the professional development co-ordinator, to look after the ICT training of 110 staff. He succeeded a high-profile post-holder who, having developed the school's laptop programme left for a job in industry. Travis' view is that an ICT co-ordinator should not be a computer buff:

“Provided you have enough background in computing to be able to use the technology for education then you're qualified for the role. It is a management role and a people skills role. To look after the professional development of 110 staff, to look after the technicians, to liaise with parents, are more important in my job than me having to fix a computer or programme in Visual Basic.”

Travis confirmed that no other directors of computing that he knew had IT backgrounds. He pointed out that one had been a librarian but the others had all been various subject teachers.

Paul Hynes at King Edward VII is in his sixth year of teaching and came to the school as a science teacher. He is Leader of ICT Development, again a third tier role. Paul is a member of the extended senior management team. He is a mentor teacher for Microsoft's Anytime, Anywhere Learning project in the UK and has a day a week free from teaching to develop work connected with laptop resources. He is also a Toshiba Ambassador and a consultant for The Technology College Trust programme for ICT in new specialist schools. Paul has been in the role for 18 months. Before that he was Assistant Director of ICT development for a year. Paul has a strong team of teachers who work with him in teaching ICT skills and certificated courses, right up to Cisco academy and advanced levels. The Assistant Leader of ICT Development, John Wordsworth, is an ex-teacher of maths of over 20 years' experience. John is a self-taught expert programmer who has created generic interactive resources for teachers and made them freely available on the web.

Neil Calvert at George Spencer School joined the school after graduating in maths as a non-teacher Information Manager seven years ago. He became a teacher through the graduate trainee scheme and is now Curriculum Leader for ICT. Neil manages all teachers of ICT and all certificated courses, co-ordinates ICT across the curriculum, and manages non-teaching staff who support ICT in the classroom and on the intranet. He is a regional co-ordinator for NOF teacher training.

Chris Rolph at Monks Dyke School joined the school as an Assistant Headteacher two years ago to lead in ICT development as part of a team. At Monks' Dyke School there is a strong team approach and another member of staff, appointed last year, is co-ordinating the Key Stage 3 ICT developments. After advertising unsuccessfully for a whole college ICT co-ordinator the senior team decided on a different management structure, involving less experienced but enthusiastic staff working as part of the team.

There is a similar approach at Cornwallis School. Here there is no ICT co-ordinator though there are several ICT project leaders all with different backgrounds, experience and levels of reward, who are co-ordinated by Ken Adam, a deputy principal. Principal, Mike Wood, feels that to have one person as Head of ICT is an impossible job. Mike believes strongly that responsibilities for ICT development should be spread widely and that schools should be careful not to set up one person for people to blame if things go wrong. At this school there are 10 Project Managers, they are mixed, internal and external appointments, rewards differ, and new teachers are encouraged to join. Some members of the team are permanent members and others are there short term.

Carol Webb is a recent appointment to one of these posts. Five terms ago she moved from a school where she had a traditional IT co-ordinator's role, which meant she was at everybody's beck and call and had so much administration and network management to do she could not develop teaching and learning. At Cornwallis she has no line management responsibilities and she has been encouraged to create and implement her own project, The Virtual Classroom, and then to disseminate its success to colleagues, and now to other teachers nationally. Carol does not have a job description; in her previous post she felt constrained by the job description. She has a 50 per cent teaching commitment and an open brief and spins off her ideas with other members of staff.

There is less of an issue of status at Cornwallis than in schools with hierarchical management models. The best person to develop a course is asked to do it regardless of their experience or formal position. The philosophy is to give teachers the space to be creative. This allows for networks of staff to develop naturally and organically. Heads of department view all this as non-threatening and supportive. The group was originally set up with one representative from every department, but now this is not necessarily the case.

With the development of ICT there has developed a new brand of leader, an instructional and transformational leader who through commitment and enthusiasm for learning, works with colleagues across the curriculum to embed ICT into the learning process. These leaders have often come up very quickly through the ranks and their ICT skills have been learned on the job.

Other enthusiastic young teachers often form lead groups, disseminating their newfound expertise and their teaching ideas to other staff in their faculties and across subjects. At King Edward VII a group of six young staff are working with an external researcher to evaluate their own production of ICT intranet resources. The ICT Development Group at King Edward VII began three years ago with volunteers from each faculty, who were given laptop computers. There is now an advanced ICT group of about 14 staff who are pushing back the boundaries of classroom practice. At Frankston High School there are five technology mentors who share good practice and help colleagues. They are given extra non-teaching periods and other teachers can book them to come into their classes to help out with new teaching ideas using ICT.

With the integration of ICT there are leaders at all levels in the organisation and these can be both teaching and non-teaching staff. The function of the principal is to encourage this web of leadership to develop. It has become evident from all the schools visited that the integration of ICT into a school is about creativity, sharing and learning from each other, and is creating new cross-curricular teams in a way that other innovations have not been able to do. It is also making the best practice from the best teachers available for all students, and for other colleagues, to benefit. In a genuinely creative learning environment the position of those who lead and those who follow changes all the time. The leaders are the ones with the appropriate knowledge and skills. Structures should be flexible enough to cope with this.

7. Leadership from Non-Teaching Staff

Adults other than teachers are playing an increasingly important role in schools around the world. This is particularly the case with the advent of ICT. Efficient systems' management is crucial to the integration of ICT for both learning and administration, but non-teachers are also significant in developing learning both inside and outside the classroom and in some cases the technical and learning support roles overlap.

Effective and knowledgeable systems managers are a new but still rare breed. Tim Fox, the systems manager at Monks' Dyke is an ex-weapons engineer from the RAF. He has been at Monks' Dyke for five years and has been central in leading the development of ICT and in managing the implementation. When he arrived at the school there were just 50 computers and now there are over 300. His team has expanded to four this year, including one who also supports primary feeder schools. Tim and his team have been instrumental in the design and setting up of the new Community Media and Learn Direct Centre. Tim has a teaching and a training role alongside his role as systems manager. For the past four years he has been part of the GNVQ Advanced ICT teams and for teachers he gives one-to-one tuition from basic applications through to web development. Two of the technicians and a teacher run the Computer Club every lunchtime. As senior technician, Tim is part of the school's leadership team when it comes to making ICT purchases.

“It is now impossible for the head or a head of department to place orders for ICT without the appropriate advice from specialists.” (Tim Fox, Monks' Dyke School)

John Smith is Systems Manager at King Edward VII School. John has been in the role for six months and came from industry. In a large school the systems manager is a leader (in terms of vision) and a manager, as well as being a skilled technician. The role needs a lot of interpersonal skills. John meets with many of the 120 teachers and 80 non-teachers who work on the King Edward VII site. He has to manage his own time and that of his five-strong team, one of whom is the outreach worker for twenty local primary, and two high schools. He is line-managed by Paul Hynes, the leader of ICT Development, but he has to move around the school talking with heads of faculty and other teachers to get regular feedback and to give support. John wants all his team to have the Cisco accreditation that will be beneficial for the school and for their careers. For several years King Edward VII worked with De Montfort University placing undergraduates as part of the team for one year. John sees the importance of networking with other systems managers and is currently talking with Brian Hitch, Systems Manager at Frankston High School, Melbourne, about how to develop secure home-school links.

Brian Hitch's position at Frankston School is slightly different. He is one of the 280 technicians employed by the State of Victoria, giving schools technical support. Brian works as Network Manager at Frankston for three days a week. Janine Waixel is the full-time Laptop Programme Technical Manager, overseeing the needs of the 800 student laptops. She has one full-time assistant. Brian was in industry before he moved to Frankston High School four and a half years ago. He has supervised the significant network upgrades, the broadband links with the state system and the wireless network installation. He has taken a lead in the development of home-school links. Janine is self-taught and came to Frankston with a belief in the laptop programme when it was started in 1995. Before that she worked as a classroom assistant in a primary school. Her role is developing all the time. She is the school contact for parents in relation to the laptop programme. She also is there for teachers who need assistance.

It is perhaps not surprising to find that Wesley College, a school of 3,400 students with their own laptops, has an extremely large and well-qualified technical team. Though, this is very unusual, the model still illustrates the importance of successful systems' management for the effective integration of ICT. There are 18 members of the support team at Wesley, led by Chris van der Weyden, an ex-teacher who has had the job for four years. Chris is part of the leadership team and he also works closely with the Head of Library and Information and the College Business Manager. At Wesley they have the same problem of recruitment and retention of specialist technical staff as other schools across the world. The average length of service for the technical staff has been seven months. The college has had to start paying better salaries.

"When an infrastructure is critical to the running of the organisation on a day to day basis it cannot be allowed to fail. The support structure has to be there to keep it going. The support team has to know what the teachers need. The focus for the support team's professional development has been customer service." (Chris Van der Weyden)

As a senior manager, Chris attends each campus's fortnightly computer committee, which includes the Head of School, Head of Learning Technology, and the Curriculum Co-ordinator. He is also a member of the College Computer Committee, which is convened by the principal and which includes the Head of Learning Technology from each campus, the Head of Library and Information Service and an Associate Principal. This is a powerful group that makes recommendations to the college leadership.

In the UK there has been an ad hoc growth of technical support teams and systems' managers. The kinds of team in the study schools are not just there to sort out the technical problems and keep things working, though these are crucial functions. They are also, and importantly, part of the teams who are developing the learning infrastructures of the schools. They relate directly to the teachers and non-teacher resource assistants in the schools' creative processes. This is a very different role to that played by 'managed services' from hardware suppliers. To reach a state of true integration, the school, or cluster of schools, needs to have a team of technicians who work with the management team and the teachers to ensure that ICT is seamlessly provided in a daily and transparent way. They also need to play a part in the development planning of the school or group of schools. The implication from this is that there must be a recognised career and training path for these vital members of staff.

Louise Bywaters and Julie Watts writing about the ICT experience in South Australia (June 2001) recognise that the people coming to these vital technical support roles have often been self-trained and have had little opportunity for in-service training:

"Personnel redesign for organisational and classroom efficiency requires insightful leadership, skilful position analysis, reorganisation and retraining."

8. An Intranet for Learning

All the schools see one of the keys to changing pedagogy to be the development of an intranet of curriculum resources, for all ages and abilities, which is available at all times of day at school and at home. All the schools in the survey know what they want, but achieving it with time restraints is the difficulty. Questions to be asked by principals include:

- How far can individual schools develop an intranet alone?
- How relevant to our situation and our students are commercially produced resources?
- What staffing and structures need to be in place to develop intranet resources?

Trinity Grammar School, Melbourne has had a laptop computers for all policy since 1994 and is now at the stage of re-developing their intranet. In making this a priority the Principal has appointed a full-time intranet developer, Rob Flavell. Rob was an outdoor education teacher whose professional development led him to ICT. In another school he became an IT teacher and ran the school's web site and the intranet. He realised that he was doing three jobs at once and when he saw the web-developer's job advertised at Trinity he applied. At the interview he sensed that they did not fully know what they wanted out of the job and he has grown into the role in the past twelve months.

"They were trying to hire a computer programmer who could produce a really slick intranet. I have changed their outlook on that. I wanted to make the thing useful from the outset. As a teacher I saw that there were things that would work." (Rob Flavell)

Before Rob came to Trinity the intranet had been developing for two years, run by a teacher who had a full-time teaching timetable and used student labour to input resources. The principal realised that this was not the way to change pedagogy.

At Trinity Grammar, as in many UK schools, a great deal of money has been spent on the ICT infrastructure, but the time has come to prioritise the learning resources. So far individual staff enthusiasts have developed the intranet. Rob feels that because of lack of time staff have not been able to think through the full potential of placing learning resources on the net. Now that the school has a wireless network and there is home-school access there is a whole range of opportunities for developing interactive resources. To extend the range of resources for the school they have joined with four other schools in a learning resource development project with a commercial organisation, Macromedia. The company is providing training for lead teachers in all the schools, in the creation of learning resources for the net. Rob alone cannot create learning resources for all subjects; teachers must be involved and for this they will need time. His estimate is that if three or four teachers had a 50 per cent timetable for a year it would make the difference required. An issue for the new consortium working with Macromedia is the one of intellectual copyright, and this is one for all teachers and schools placing their resources on the web. Paul Hynes at King Edward VII has strong views on this:

"Those who are leading the development of ICT learning resources should lead by example and make everything available to other teachers. Other schools should be able to use these and develop them for their own situation."

Paul does not believe in schools selling online curriculum resources:

"It plays upon schools' insecurities with new courses and these resources tie schools down to a mode of delivery and do not allow the flexibility for differentiation and adding resources for the most able and so on. Teachers feel compelled to use the resources because of the price they have paid for them."

Paul feels that teachers prefer to have access to ideas and resources from similar colleagues that they can change and develop for their own use. "We are not looking to create robot teachers, but in developing the online curriculum we want people to use their own personality and still do the genuine teaching job".

Even with a full-time web developer like Rob it takes time to create a viable school intranet. By the end of next year Rob expects that at Trinity, a school with a long ICT history, just under half of the teachers will have added resources to the intranet themselves and 10 per cent of these will have employed these resources fully for 'real e-learning'.

In most schools with intranets the development of the learning resources is uneven and related to the enthusiasms of individuals or groups of teachers of certain subjects. Eventually these enthusiasms will rub off, but this is too important a development to take place incrementally, in an ad hoc manner. The teachers need time and they need support and co-ordination. At King Edward VII there are a number of learning resource assistants who can support teachers in the development of learning resources for the intranet and who support students in the independent learning areas and clusters. There is also a specific learning resource assistant in science. She has been in post for two years and is one reason why most of the school's science curriculum is online. The others, newly appointed, cover humanities, modern languages and English. This model may be extended across the school if the budget priorities will allow. At George Spencer School there are three non-teacher information managers, two of whom are graduates. They are available in the two resource centres for supporting students with independent learning and for adapting teacher materials to the online environment. The third is also available at any one time to be booked by staff to help out with ICT-based learning in the classroom.

A complex situation is developing world-wide with governments looking for a fast return in the development of online learning resources and a gap developing between the slick commercially 'answer to all' resources and the teachers. At the same time the commercial sector is obviously looking for a profit. The answer lies with a combination of real teacher expertise and commercial know-how to develop resources available free, or at a reasonable price, which teachers can use and further develop for their own students in their own schools or for clusters of schools. To get to this it is important to invest in training and time for teachers, who are identified by principals in their own schools and released from teaching, in order to help develop materials. But release time needs to be balanced against curriculum timetable demands during this period of subject teacher shortages. This careful balance requires that schools where the talent is to be found are consulted carefully by co-ordinating organisations such as Becta and incentives given to those schools, which will fully engage them in the development process. Within all this there is an opportunity for fruitful public and private partnerships between schools and the industry.

"What is needed in the UK is ... enabling legislation which will allow bottom-up grids to be built by communities of users ... A touch of anarchy and rather less of the institutional and formal could create more than even the large sums of money currently being spent are capable of ..." (Abbott, 2001)

9. The Changing Relationship Between the School and its Community

"Once we can surmount time and space and be anywhere, we must choose a place at which to be, and the computer's functionality lies in its power to make us organise our desires about the spaces we visit and stay in." (Jones SG (Ed), 1995, quoted in Abbott C, 2001)

It is important for school leaders to realise that changing the way students learn, using ICT, is not a step-by-step process. The technology itself is changing at a rapid pace and offering new opportunities all the time in a world of permanent change. Home-school access is not something you wait to do when you have everything else in place. We will be overtaken by events if we do this.

Computer devices have an important place in most homes in the UK and in 2001 about 40 per cent of households have internet connection. The government's target is for all homes to be connected to the net in the very near future. The faster rate of connectivity in the USA and Australia would indicate that progress towards this goal would be rapid. The EC Report *Tomorrow's Education: Promoting Innovation with New Technologies* (2000) suggests that the rapid expansion of home ownership will enable schools to see their role in the provision of ICT as a partner in the educational process rather than a sole provider. The changing role of the school in its community must take into account the overall use and provision of ICT for lifelong learning. The school as a learning organisation has an important role to play in this.

“The obsolescent assumption underlying schooling, education and learning is that it involves the transfer of skill, expertise or knowledge from an expert to a novice, and this action has been known as teaching ... Information technology will inevitably explode this conception of schooling, or some of it, by making available to learners huge resources of information which they can access and make use of, independent of teachers.” (Beare, 2001)

One million Australian dollars were made available from Multimedia Victoria to enable schools in regional and rural Victoria to provide for their communities with access to the internet and to their ICT facilities. The programme is to provide 12,000 community members with over 60,000 free hours of access to the internet. By October 2001 12,224 community members had already accessed the internet for 61,122 hours. The Education Department in Victoria has received \$2.5 million from the Australian government Networking the Nation initiative to continue the programme.

Schools in Australia, the UK and Singapore are individually making progress in connecting with their students' homes so that students and their parents have access, not only to the school intranet of learning resources, but also to the private work area of the individual student. The technical hurdles to achieve this are not high. At Bukit View Secondary School, Singapore, 60 per cent to 70 per cent of all students can access their work areas from home. At George Spencer School, UK, 100 per cent of Year 7 students have access from home and around 80 per cent in other years. Tom Clark, working closely with a private company, NTL, has created this situation. The Year 7 strategy, which began this year, is part of the process of re-engineering the Key Stage 3 curriculum, 'Mapping higher order ICT skills against learning styles, against curriculum.' Tom Clark explained that 100 per cent access from home meant that students could learn at their own pace away from the classroom using resources appropriate for their preferred learning styles.

“The real issue is the degree to which, after acquisition, ICT enhances learning and makes a difference by giving youngsters access to their preferred learning styles.”
(Tom Clark, George Spencer School)

Tom Clark's experience is that home-school access has made a real difference to the relationship of the school to its parents and to the local community. Five years ago the school started putting on free courses for parents in ICT skills. Parents formed a closer relationship with their school and the connectivity certainly makes school more evident in the home.

David Loader, at Wesley College, also commented on the changed relationship of school and parents.

“ICT makes teachers more immediately accessible to parents. It gives more authority in parents' hands; they are actively players. Good parents can support you and a bad parent can make life difficult. The more information you give means potentially more work for the school.”

ICT integration and community learning go hand in hand. At Monks' Dyke Technology College the new Media Centre, includes an independent learning centre which is open all day and every evening to members of the local community. When King Edward VII School became a technology college in 1997 the initial capital programme included setting up and running an independent study centre with 50 networked computers that is open every day from 8am to 7pm. As more and more homes have access to the technology the need for this centre will change. Another community based ICT project at King Edward VII is the Eco Centre that brings up-to-date technology to over 20 feeder primary schools. The centre itself consists of one large open area encompassing a laboratory, a meeting/work space and a space for 15 networked computers. Over 5,000 primary school pupils have used the centre over the past three years. The primary schools also have the advantage of eight laptop computers, which can be borrowed for up to four weeks at a time for use in the primary school, or for fieldwork.

The integration of ICT necessarily changes the school's relationship with the local community. Schools are becoming focused learning centres for their connected communities. Home-school access is inevitable and this enables parents to continue to be active partners in their children's secondary education in a way that has not been possible before. The school's web site and intranet can also form part of their local area web site. It is easy for families moving into the area to access all they need to know about the local schools without asking for the prospectus. But much more than this, the curriculum resources online form part of the local provision for lifelong learning.

All of this has implications for the staffing of the school and the development of partnerships with social service agencies as well as with other schools and colleges.

10. The Laptop Experience

“From the introduction of laptops, monumental consequences flowed. A school, its culture, curriculum and its teaching-learning paradigm began to be transformed.” (Loader, D. 1997)

The schools in Australia and the UK that have embraced laptop computers have found that they have changed the relationship between the school and home quite significantly. By far the greatest body of evidence for the effects of laptops on teaching, learning and learning communities comes from Australia with its 11 years' experience. In 1994, Ken Rowe, the Principal at Frankston High School looked at the experience of David Loader at the Methodist Ladies College in the independent sector in Melbourne and in 1995 Frankston became part of a research programme with the Australian Council for Educational Research to examine the effects of laptops on student learning. The Government supplied funds to equip a group of Year 7 (UK Year 8) students with laptops. Initial results convinced enough staff at Frankston that this was the way to go. They saw that boys became keener to produce and present their work using computers and that engagement with laptops was encouraging higher order learning skill development.

Parents of Year 7 students were asked to volunteer to come into the laptop programme by purchasing machines for their children over a three year period and 141 agreed to take part; at the same time 41 staff volunteered to take part. Now 60 per cent of every Year7 intake regularly takes part in the laptop scheme so that by January 2000 there were 800 students with laptops in the school. The school also has some class sets of laptops as well as desktops in specialist areas and in independent learning centres, which means that students who do not own their own laptop still have an ICT-rich educational environment.

This progress to 1:2 ratio could not have been made without involving parents as partners in the way forward with ICT. Parents in Melbourne chase places at Frankston because of the success of the laptop programme. They, and their counterparts who pay for education in the Australian independent sector, readily see the importance of laptops from vocational and learning viewpoints. Ken Rowe has found that paying for laptops means a real commitment on the part of parents. The school also has two laptop scholarships a year for students who might otherwise not be able to afford them.

“For students here the laptop is highly valued and is the most precious thing for the family outside of their house and their car.” (Ken Rowe).

A similar experience has taken place in some UK schools, including King Edward VII and Cornwallis. Both Ken Walsh and Mike Wood were convinced of the value of portable computers after looking carefully at the experience of schools in both Australia and the USA. They introduced laptop policies into their schools in 1998 and are now mentor schools for Microsoft's Anytime, Anywhere Learning Community in the UK. At Cornwallis Mike Wood raised finance for the scheme for laptops in Year 7 and at King Edward VII, Ken Walsh involved parents in purchase of machines for Year 10 students. The school now has an E-Learning Foundation, a charitable trust aimed at providing access to technology on an equitable basis. From small beginnings the number of laptops at King Edward VII has grown from 33 to over 500, with 130 of these for staff use.

Both principals talk about the involvement with parents and how laptops change the school's relationship with parents. Both schools have provided training for parents and they have noticed how a greater percentage of laptop tutor groups' parents attend parents' evenings than do parents of non-laptop groups. Mike Wood commented on how laptops had got parents thinking about education, even if they started off by questioning about the possible loss of handwriting skills!

There is also an accountability that the school has to the parents and students to ensure that the laptops are being used profitably in school and for homework. The school must also ensure that the support systems are in place so that laptops needing repair stay out of use for the minimum amount of time. Many lessons have been learned on both scores. Certainly, there is pressure on staff to have laptops used in their subjects and to get learning resources and homeworks on line. In relation to support, King Edward VII now has a laptop manager, a member of the support staff who deals directly with students and their parents. King Edward VII also has a regional Toshiba repair centre on site, an enviable position that has been negotiated with their laptop retailer.

11. Staff Training

“With the increased use of laptops, staff find many dimensions of their occupational roles changing, including the cultural setting, work standards, required skills, hierarchy, salary and career opportunities.” (Loader, 1997)

All the schools in the study placed staff training at the centre of their successful integration of ICT.

“Teachers need to be helped to see the possibilities and encouraged to explore the potential for themselves ... What will not have the required effect is a programme of entirely skill-based rather than reflective teacher education.” (Abbott, 2001)

In the schools visited the leadership of the training of staff came from deputy principals, from ICT leaders, and in one case from a specially appointed non-teacher training manager.

At George Spencer School all new staff were contractually obliged to reach a certain level of ICT training by the end of their first year with the school. All staff members' performance reviews had to include one ICT target. At Frankston High School attendance at the weekly ICT training sessions are acknowledged on their annual review statements. There are a large number of ICT training opportunities and George Spencer, like the other schools in the survey, has built up a body of experienced trainers who are advanced users of the technologies for learning. All the schools usually made a specific evening available for staff training for individuals and groups on a bespoke basis.

King Edward VII School had set up an ICT training centre at the heart of the school. The training centre consists of four large rooms and an office for the training centre manager. One very large room, formerly two classrooms, has an electronic whiteboard, wireless network access for laptop training (as has the rest of the Centre and the school) and flexible seating to allow for a boardroom, lecture or informal meetings format. Next door there is a 16-station desktop training room with LCD projection facilities, which is available for staff throughout the day. The video conference training room allows for video conferences with staff of other schools across the world and for training on video conferencing itself, linking with another facility elsewhere on the site. There is also a smaller room for workshops and group meetings. Since it opened two years ago the centre has been responsible for training all the school's teaching and non-teaching staff and has been used by other schools in the area for NOF and applications training. The centre manager comes from a professional training management background.

The high profile presence of the ICT training centre in the heart of the school sends important messages to students, staff and visitors about the importance placed on ICT in the school. The high standard of training available in convivial and comfortable surroundings recognises that teaching and non-teaching staff alike require their training needs to be taken seriously. At the same time, having the ICT training centre on site is very cost-effective and having a separate training manager means that it is run as a business. Although it does not make a profit, the hiring to local and sometimes national agencies for training helps towards the staff-training budget.

Apart from NOF training, the teaching and non-staff at King Edward VII are awarded school-based certificates for training and are accredited specifically by gaining the European Computer Driving Licence (ECDL) and more recently Intel. The programme of ECDL professional training has ensured that most staff have acquired good levels of ICT skills. Most teaching staff have gained a broad understanding of functionality extended through the use of commonly used applications. The ICT training has generated a culture of self-learning and has enabled cascade training and buddy systems of support in faculties and across the school in general. Importantly the ICT training has given teachers confidence in maintaining an equal pace with their students. The 10 Intel Teach to the Future training modules are primarily focused on developing ICT resources for use in the classroom. They are 'hands on' and practical and allow teachers the opportunity to test out materials in a safe environment whilst at the same time networking with colleagues and sharing good practice. All IT teachers have attended Cisco training and Cisco training courses are provided for sixth form students.

Whether or not they have specific training areas set aside, in all the study schools' access to ICT is readily available to all staff. At some all staff could access their work from home and at most staff had the use of their personal laptops at all times. This latter method of involving staff with ICT every day with the opportunity to work on classroom resources at anytime and anywhere was seen by several of the heads as the best way forward. Paul Doherty, the Head of Learning Technology for Victoria commented on the success of the Victoria Laptop for Teachers scheme, which meant that from a three-year rollout virtually all primary and secondary teachers now had their own laptop. He felt that this was the most cost-effective way to revolutionise teaching and learning to take account of ICT. Longitudinal research undertaken by the Victoria Department for Education, Employment and Training has shown that access to technology by teaching staff is the main barrier to the effective take-up of ICT for learning in schools (Paul Doherty, 2001).

Most of the study schools had a professional development co-ordinator at vice-principal or third tier level and in most cases this person worked closely with the member(s) of staff responsible for leading ICT development, in devising the ICT training for the staff. In schools where ICT had been established for some time the need for basic applications' training had receded for all but new members of staff.

“Professional development is now at least at an intermediate level with sessions on e.g. importing graphics, using Excel spreadsheets, and creating web-pages, all specifically related to teaching and learning. At the same time we have advanced practitioners and sometimes outsource professional trainers. There are four staff members who network with other teachers elsewhere at a very advanced level.” (Judy Hunter, Frankston School)

Leaders in England pointed out the relative failure of the Computer for Teachers scheme to influence teaching and learning and the failure of NOF training to deliver results cost-effectively. Abbott (2001) describes the UK NOF training as ‘the kind of situation which OFSTED might describe as adequate but with considerable room for improvement’. NOF training did try to engage teachers in the process of integrating ICT into their work but for many, who had not reached the basic applications stage, it was too early and for others it was too restrictive and bureaucratic. Many were not ready for the online aspects of the training.

There is actually a great body of experience that has developed in certain schools which, if tapped successfully by freeing up teachers regionally, without taking them away from their classes entirely and forever, could be part of a very vital training network, face to face and on line. Schools need incentives to bring this body of expertise into play.

12. Integrating ICT into School Administration

Decisions about administration systems were seen as crucial to the effective functioning of the school. All the schools, bar one, had developed highly sophisticated uses of ICT for school administration and they had pioneered various applications such as students' assessment and data retrieval systems and electronic registration and they all felt that mistakes had been made which could be learned from. All the schools had provided between 50 per cent and 100 per cent of teaching staff with laptops and saw this as one of the most significant moves towards full integration where staff were using the technology in school and at home for lesson preparation, student assessment and other aspects of administration.

“There is a seamless divide between work done at school and at home.” (Kath Lee, King Edward VII School)

Principals have many considerations to make before introducing or changing a system. One school in isolation, most often, cannot take these decisions.

“We have to consider our feeder schools and the effective transfer of data. We have to consider the wider picture of the LEA and nationally. We stayed with our system, even though there were things we were not happy with, because of the transferability of data.” (Kath Lee, King Edward VII School)

Schools often find that their various administrative needs are not met by one system and that compatibility between applications is a problem.

“With administration we still have a long way to go. We look at our integrated management systems; we get them and we find that they don't do what we want. The assessment package for example needs to be compatible with timetabling and curriculum. Our MIS seems to require the dual input of data. The problem is, once started with a package you are committed to it.” (Sue Williamson, Monks' Dyke)

Davies and Ellison (1997) make the crucial point that a school needs to be clear about how it wishes to manage information and communications, what needs to be communicated, when and to whom, before it is in a position to identify the data and decision support systems that can be supplied through an IT solution. They suggested that schools carry out a communications audit.

Decisions on the right administration packages are crucial and must also be based on the expert advice of someone who knows the schools' needs and who has knowledge of what the packages can deliver. At King Edward VII School a senior committee spend a great deal of time in researching the appropriate packages before decisions are made. Both Sue Williamson (Monks' Dyke School) and Tom Clark (George Spencer School) advise visiting at least three other schools and talking with colleagues there.

“Spend some time there with staff who use the packages and have your ‘experts’ spend time at the other schools. Try to select schools that have similar needs to your own.” (Tom Clark)

“A good salesman can tell you how easy it is to use a package, but a good colleague will tell you about the pitfalls. You should never feel you are losing face by asking a colleague for advice.” (Sue Williamson)

School bursars or business managers are often the leaders who will be involved in making major decisions about administration packages, and so they should be, as they are people who make full use of them on a daily basis.

13. Budgeting for ICT

Whatever the background of the school and the feelings of the staff and governors about raising extra funds, ICT integration is costly and demands a change to budget priorities. However, there are very few schools where there is no possibility of re-prioritising.

It is true that the pioneers of integrating ICT have mostly been entrepreneurial principals who have decided to go all out for the best and most equitable access to computers for their students at school and, in some cases, at home. On the other hand, where there has been a lot of support from the state, as in Victoria, this has not been as necessary. Every year principals are faced with the need to reprioritise budgets. There needs to be an understanding that after reprioritising for ICT there needs to be a sustainable budget plan for expansion for a period of three years, to be followed by an annual replacement and upgrade policy. Buying or leasing computers and installing networks and supporting their maintenance is not a one-off budget decision, it requires a serious engagement forever. But ICT is with us forever; it will not go away.

The principals in the study did not wait for someone else to pick up the bill for the changes; they knew that this would never happen unless, perhaps, they were in Singapore. Schools generally are in charge of their own destiny to a large extent and principals need to know how to achieve their vision both as the chief executives of the organisation and as the leaders of learning.

“... educational leaders can and should readily embody an integration of technical, pedagogic, professional and managerial skills – characterising what Hughes (1998) has described as the professional as administrator, albeit a role underpinned by a clearer focus on technical competence.” (Law and Glover, 2000).

Sue Williamson (Monks' Dyke School) made it clear that if you want the best for your students in ICT, ‘you cannot rely upon statutory funding and you have to be creative.’ Her new media centre was partly funded from European funds that she and her team went out to get. She also felt, as do other principals, that no area of the school curriculum has been neglected because of moving ICT to a top priority position, rather the opposite, since an integrated ICT policy positively affects all curriculum areas. Heads of faculties need to know exactly what the costs are and what benefits come to them via the policy.

At George Spencer School, Tom Clark took a view seven to eight years ago that all young people needed IT literacy for the future of their lives, the country and the global economy. The school chose to make a significant investment in ICT, not because they had extra cash, but because they had decided they must use the budget they had to change the learning priorities. Their pioneering work and approach did lead them to obtain valuable business partnerships but these came because of their belief for their students and their families. In making significant budget decisions about ICT Tom relies upon the experts he has appointed; he has a three-year balanced budget so that all curriculum areas are catered for.

Mike Wood at Cornwallis provided laptops for Year 7 pupils by taking out a three-year leasing scheme. He says: 'The head who says that they can't budget for laptops is not thinking things through practically. It just takes imagination to look again at the priorities.'

Davies and Ellison (1997) point out that the most important aspect of school autonomy is the reconsideration of whether or not the available money is being used effectively. 'This is where there is scope for leadership, vision and lateral thinking ... skilful management of the external financial boundaries is now an important competence for school leaders.' Davies and Ellison provide useful, practical guidelines for combining futures thinking with strategic planning.

"I'm annoyed when a principal says it's not my responsibility to provide the technology for my school. I want to provide my students with the best education I can get for them, and my community is happy to support it." (Ken Rowe, Frankston)

14. Governments and ICT

"Over the six years from 1998-2004, we will have invested a total of £1.8 billion in ICT in schools. Increasingly, this means that schools have the equipment to use ICT to tailor education much more directly to the needs of each individual." (DfES, *Schools Achieving Success*, 2001)

Abbott (2001) points out that changes in ICT are revolutionary but that changes to most education systems are slow and evolutionary. The current UK Government has recognised the importance of ICT to the success of the UK in a global economy. The white paper *Schools Achieving Success* (2001), which refers to the 'enormous potential' of ICT that makes it possible for 'each child to be educated in a way and at a pace which suits them' (para 3.12), 'opening the way for a new pedagogy' (para 3.25). The vision is for the whole National Curriculum to be online with learning resources available for all age and ability groups.

The State of Victoria, Australia has a significant recent history in promoting ICT as The Learning Technologies (1998). Their policies have been based upon:

- Equitable provision of learning technologies, infrastructure and educational services
- Skills development in learning technologies
- Development and dissemination of content and teaching resources.

They have an active involvement with negotiating centrally for best value contracts for ICT products and services. Education is the largest customer to the whole of the government-wide area network (VicOne) and SOFWeb is the most heavily used educational web site in Australia, with 35,000 web documents and downloadable files. Two-thirds of Victoria teachers are known to regularly make use of SOFWeb resources. Technical support to schools has been a government priority. Training has been centrally provided for the technicians, and teacher involvement with ICT has been stimulated by the laptop scheme which, over three years, has provided 85 per cent of the workforce with electronic notebooks and which is now a sustainable scheme with ongoing three-year update replacements.

In 1998 the state of Victoria made a statement about what they wanted to achieve in terms of the learning technologies:

- to move learning technologies into the charter (development plan) of every school
- to move learning technologies into the duties, requirements and performance management of the 1600 principals.

The role of the State Education Department in Victoria is seen as supporting and assisting the development of the learning technologies. The leadership comes from the schools. The Department for Education and Training provides a corporate email system for all schools and government services. Every desktop computer in Victoria schools is subsidised by the state by 25 per cent. Funding is provided to each school specifically for spending on purchase or leasing of computers or other ICT infrastructure in a similar way to the National Grid for Learning (NGfL) in the UK. In Victoria \$23 million has been allocated over the next three years: \$13 million for computers; \$9 million for improved internet access and networking; and \$1 million for computers for students studying by distance education. This will ensure that all schools will have a minimum 1:5 computer to student ratio.

The State's Information Technology Manager is available to give principals advice on purchasing hardware and software. *Curriculum Works* online has now accumulated about 10,000 examples of good work by teachers and \$80 million dollars is being spent by the federal government over the next two years to develop online resources for all subject areas. In Victoria the Education Channel has 200 affiliates worldwide. Web sites are trawled every night to make 250,000 high quality resources available that are relevant to the curriculum in Victoria schools. Teachers and students can look for resources in one spot and access a directory to relevant sites, with indicated gradings for primary and secondary use. The gap between schools that have integrated ICT and others in Victoria is narrowing with the state intervening in schools that have lagged behind. The laptop programme for teachers is seen to have unleashed resources that schools did not know they had.

The success of integrating ICT into Victorian schools has important lessons for the UK.

- Victoria realised early on the vital importance of involving school principals in the process. They insisted on the use of email for communication with the centre. Principals had to learn the skills or be isolated.
- They realised that the teachers had to have access to the tools for learning and they set about ensuring that all teachers had computers that had a very good chance of affecting the way they worked; these would be mobile devices.
- They set about ensuring that all schools had broadband access to the internet.
- Concurrently they started to develop learning resources and teacher training online.

When compared with Victoria the UK has problems of scale. However, some of the lessons from Australia could be applied in some LEAs and in some of the regions of the UK. The laptops for teachers programme could be effectively applied throughout the UK if the money were to be partly delegated to schools and matched by training and development funds already delegated in the Standards Fund. In the UK schools could be the actual owners of the laptops and teachers would have them for their own total and individual use for the duration of the time they are employed by the school.

When asked why the schools in the State of Victoria in Australia were ahead of much of the world in the integration of ICT, Paul Doherty replied: 'The mums and dads of Victoria more than anyone else have driven the ICT proposition in our schools. The parents have required school leaders to develop ICT'. There is a clear drive from parents for their children to attend schools where the technology is used every day. In Australia, parents across the socio-economic range have taken the technology on board very quickly and parents are willing to contribute to the cost of providing school hardware in a way that is not common in the UK. This is probably linked to the attitude of many parents that everything in the state sector should be provided free of charge and resentment towards having to pay directly for schoolbooks and equipment. Although there is a lot of evidence to show that families in the UK are keen to latch on to new developments in technology, their purchases are more often connected with leisure equipment (videos, games machines, mobile phones etc) than with buying equipment directly for educational use.

In Singapore the government has adopted visionary, practical and sustainable policies to provide hardware and support to schools and transform learning. All teachers have one laptop between two and the target for 2002 for all primary and secondary pupils is a student: computer ratio of 1:2. All schools have broadband connectivity and technical support. The problems of developing the pedagogy to match the hardware provision in the state sector in Singapore is associated with class size and an emphasis on testing that seems greater even than in the UK. With class sizes of forty, in classrooms that have not been re-designed to accommodate the computers, teachers have some difficulty in using ICT for learning.

"The Ministry has been generous in relation to providing computers for schools, for students and teachers, but about making a difference to learning there is a long way to go. The average teacher does not have time to be creative, with one 30-45 minute period free from a teaching day and classes of 40. So many grab hold of the CD Roms and many of these are more relevant for US students." (Jason Tann, National Institute for Education)

There are conflicting messages from the government. They have officially reduced curriculum content by 25 per cent to make way for the problem solving skills and project research associated with ICT. At the same time they have declared that all project work has to be done in school so that parents cannot do the work for their children.

All Singapore principals are thoroughly used to administration of their schools using ICT. All communications and pupil management systems using ICT are well-established routine. All classrooms in most secondary schools are linked to the network. Teacher training is online and all teachers have email accounts.

Both the Singapore and Victoria governments have encouraged schools to link with the IT industry. In Victoria, education spends an estimated \$120 million a year on ICT products and services. The Information Technology Department in the Education and Training Ministry has negotiated 10 –15 per cent reductions for school purchases from major players. Victoria schools have free access to nearly all Microsoft products. A software rolling-fund has reduced the cost of more than 60 curriculum titles by 20 – 40 per cent. An integrated call centre has been established which has been dealing with in excess of 10,00 calls per month. In Singapore the technical support is negotiated with companies by the State and there is an expectation that IT vendors will provide personnel to state schools for the training of both staff and students. At Sembawang Secondary School there are two vendors who both provide enrichment classes in IT applications for students and staff, after school, and who are available in the day to help staff across the curriculum with using ICT for teaching. In his afternoon classes at Sembawang Mr Kok gives intensive six-week courses that students can sign up for using money from their Individual Learning Accounts (state provision). Students know all office applications already from their primary schools. In Secondary One and Two students will attend courses on using Dreamweaver to design their web pages. Mr Kok is working with an art teacher on the development of classroom work using Photoshop.

These central initiatives in Victoria and Singapore have given clear direction to school principals and have taken away some of their concerns with regard to major decisions about systems, technical support and training. Nevertheless, school principals still have the most important role in leading how the technology is integrated into the learning experiences of their pupils in their schools. Interestingly also, in both Victoria and Singapore the independent sector is recognised as having had a major influence on the development of ICT for learning.

15. Lessons to be Learned

I have been privileged to have had ten weeks away from my school courtesy of NCSL. It has been a valuable experience for me in having time to reflect on what we have achieved as a school and assessing how far we have got in the process of integrating ICT. Most heads are not so privileged as to have this time or to spend time talking with colleagues who are eager to share their experiences and the good practice of their schools. I hope that the publication of this study will be helpful to other colleagues wherever they might be on the road towards ICT integration.

At the end of each of my interviews with school principals I asked them about the kind of advice they would give to others who were at quite an early stage in the process of integrating ICT into their schools.

All agreed that principals take more on board if they are able to visit other schools and see good practice for themselves. Networking with other heads, some at a similar stage of development and others at a more advanced stage was seen as a valuable process for moving forward. This networking is important for planning the strategic development of ICT and for increasing one's individual skill base. It was seen as vital that principals should use ICT in their daily work, especially for communication with colleagues within and outside school using email. Principals need to keep up to date with their presentational skills, e.g. using Powerpoint in presentations to staff as a matter of course. Heads need ICT skills themselves, but an appreciation of how ICT is affecting the whole of learning is more important:

"I think we need heads who are fascinated by ICT, who have some skills, but it is more important that the head knows what constitutes good teaching and learning." (Mike Wood)

The networks that have developed through ICT have led to important professional development opportunities for the principals in this study. By using ICT themselves and by networking with other like-minded principals they have extended themselves professionally more than they would have done otherwise:

"Networking with other heads has had tremendous benefits. We meet people with similar interests and challenging beliefs in a context far wider than an LEA network." (Sue Williamson)

"Some American examples, which at first sight might not fit into the English system, have caused me to think more carefully about the effect of ICT on learning ... The international perspective is very important in giving the opportunity for heads to make an intellectual leap; that doesn't necessarily happen when you are just looking at the school down the road." (Mike Wood)

"ICT has given me the greatest opportunity to network with principals of independent schools and with schools internationally. The technology is disappearing out of our consciousness. We are concerned with what it can do, especially in the form of communication and international linking which is one of the school's priorities." (Ken Rowe)

All the heads in this study have gained in confidence by playing a full part in a variety of networks. They have established ICT as an integral part of their schools. They realise that in doing so they are on a roller coaster of change that will never stop. The principals who are leading the way have recognised that 'change, a constant state of flux, is not a passing phase but the natural environment online ...' (Abbott, 2001).

They are also all more concerned with learning than with technology:

"From now on the vision is concerned with re-engineering the curriculum, mapping higher order skills against learning styles, against curriculum. The real issue is the degree to which, after acquisition, ICT enhances learning and makes a difference by giving youngsters access to their preferred learning styles." (Tom Clark)

All the principals saw the keys to the successful integration of ICT in appropriate and sustained professional development of staff, in teamwork, of empowering individuals and the school as a whole:

"We have to give teachers time to do some of their own thinking. We need to change teachers from being isolated individuals to being part of teams." (David Loader)

"The experts in ICT in subjects in the school give life and vitality to the vision." (Tom Clark)

"The principal needs to identify the runners and back the runners to run." (Ken Rowe)

All the evidence to date in the progress towards ICT integration in schools points to the importance of the role of the principal. Leaders need to have the confidence to make organisational, structural and curricular changes based upon an understanding of the nature of learning and the nature of change.

"The principal's role is paramount in the introduction of any initiative. Everyone in the school community knows that I am totally committed to it. When we started we took an enormous risk as a government school going down this path (of providing students with laptops)." (Ken Rowe)

Principals who are leading the integration of ICT in their schools need to possess technical, pedagogic, professional and managerial skills. The principals in this study have managed to combine the entrepreneurial role of the chief executive, ensuring that their schools are appropriately equipped, with that of leading professional, leading the transformation of teaching and learning. As Law and Glover (1998) point out, the combination of the two roles can be 'mutually reinforcing and complementary – helping to create a vital professional synergy'. The principal is therefore seen as the head learner, a role that demands the skill of asking the right questions rather than providing the correct answers.

Schools that are leading the way internationally are leaving behind the equipping phase and are using new and flexible management structures, to enable the creation of learning environments where the agenda passes from the teacher to put the student in control of his or her own learning. The process of integrating ICT in these schools is one not concerned with the technology per se, but concerned with making a provision for learning which recognises a range of learning styles. All the schools that are at this stage have also recognised that the future is one of collaboration in the development of learning resources between like-minded schools wherever they may be. The skills of leadership for the future can and should be acquired by a sharing and an interdependence that reflects the essential openness of the internet itself. Principals should be reassured that at least the help, if not the truth 'is out there.'

16. Methodology

This study is based upon findings from interviews with school principals and others in leadership roles in four UK secondary schools, three in Victoria, Australia and two in Singapore. With two exceptions, in Australia, the schools were chosen because they were typical state schools with catchment areas which had no particular advantage or disadvantage, but where the national reputation of the school suggested that leadership of a distinctive kind had enabled the school to make considerable strides towards the integration of ICT. Semi-structured interviews were conducted in each of the study schools, first with the principal, then with significant leaders in the school, identified by the principal as colleagues who have had a major impact on the development and integration of ICT. Interview discussion included questions designed to elicit information that included:

- respondents background and involvement with ICT
- understanding of the effective integration of ICT
- the use of ICT for administration
- the integration of ICT into learning
- the leadership skills needed to make full use of ICT
- its impact on staff training
- its impact on budgeting
- any consequent changes in management structure
- if ICT had affected the schools relationship with the wider community
- advice for other principals

All the interviews were recorded and then transcribed ensuring that quotations to be used in the study were accurate. The responses were thematically analysed and the views and opinions of respondents in the same institution were carefully compared to check for any possible biased perspectives.

17. Acknowledgements

The author is grateful to the following schools and individuals for their participation in the study:

- The Cornwallis School, Maidstone: Mike Wood, Ken Adam, Carol Webb
- George Spencer School, Nottingham: Tom Clark, Neil Calvert
- King Edward VII School, Melton Mowbray: Paul Hynes, John Smith, Sylvia Paddock
- Monks' Dykes Technology College, Louth, Lincolnshire: Sue Williamson; Chris Rolph; Paul Marsden; Ros Webber-Jones; Tim Fox
- Frankston High School, Melbourne: Ken Rowe, Travis Smith, Brian Hitch, Janine Waixel, Judy Hunter
- Trinity Grammar School, Melbourne: Rob Flavell, David Bevans, Colin Potts
- Wesley College, Melbourne: David Loader, Chris Van der Weyden
- Sembawang Secondary School, Singapore
- Bukit View Secondary School, Singapore
- Paul Doherty, General Manager, IT Division, Department of Education, Employment and Training, Victoria, Melbourne, Australia
- David Gurr, University of Melbourne
- Jason Tann, National Institute for Education, Singapore
- James Ong, Bukit View School
- Mrs Tang-Chan Yueh Tarn at Sembawang Secondary School

18. References

- Abbott C, (2001). *ICT: Changing Education*. Routledge Falmer: London.
- Beare H, (2001). *Creating the Future School*. Routledge Falmer: London and New York.
- British Educational and Communication Technology Association (Becta) (Nov 2001). *ImpaCT2, Interim Report*, www.becta.org.uk
- British Educational Suppliers Association (Besa) (Nov 2001). *Information and Communication Technology in UK State Schools*. www.besanet.org.uk
- Bywaters L, Watts J, (2001). *Leading the School Community in the Information and Communication Technology Age*, Online discussion paper for the Vision 2020 Technology Colleges Trust International Conference, June 2001.
- Davies B, Ellison L, (1997). *School Leadership for the 21st Century*. Routledge: London.
- Doherty P, (2001). *Learning Technologies in Schools*, PowerPoint Presentation for Victoria Principals, Department of Education, Employment and Training, Melbourne, Australia.
- Department for Education and Skills (2001). *Schools Achieving Success*, HMSO: London.
- Illich, I, (1973). *Deschooling Society*. Penguin: Harmondsworth, Middlesex, UK.
- Law S, Glover D, (1998). *The Leadership of Change*. Open University Press: Buckingham, UK.
- Law S, Glover D, (2000). *Educational Leadership and Learning*. Open University Press: Buckingham, UK.
- Loader D, (1997). *The Inner Principal*. The Falmer Press: London/Washington.
- Papert S, (1993). *The Children's Machine*. Basic Books: New York.
- Richardson T, Anstey P, (2001). *Future Schools: Report to the NCSL Governing Council*, National College for School Leadership.
- Bowring-Carr C, West-Burnham J, (1999). 'Creating a Learning Culture' in Bowring-Carr and West-Burnham (eds), *Managing Learning for Achievement*, Financial Times/Pitman Publishing: London.
- Correspondence to the author: kwalsh@ke7.org.uk