Knot Society. The work with Keys88 was, however, central to the learning experience, designed as it was by the teacher who tailored the other elements of the learning environment to dovetail with the unfolding weekly discoveries made on the computer. Thus the wounded cavalier, hiding in the tythe barn in fictional Myddleham, was introduced in the week of the class trip to the Royal Oak and Boscobel House while complaints of damage to the church in Myddleham was reinforcement for the real evidence of musket damage to the walls of Malmesbury Abbey as viewed on a previous visit.

It is the control which authoring software, such as Keys88, gives to the class teacher to construct relevant materials for their individual pupils allied to the inbuilt motivational properties of the program that makes the historical information that the teacher has collected and arranged a meaningful and motivating learning resource.

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More than a decade has passed since the introduction of computers into schools and yet they have failed to be taken seriously as an educational tool in many classrooms. Education is failing to keep pace with the changes taking place in society as a whole. Our schools seem out of step with what society requires now or will require in an uncertain future.

Many teachers are becoming disillusioned with their occupations. Our communities have much less regard for teachers and education than in other countries, e.g. Japan and China.

As if all this weren't enough, Australians are particularly worried about their future. On a wider scale, in the words of Dr Peter Ellyard (1989), former Director of the Commission for the Future: 'Our country is struggling to repair its economy in a world dominated by rapid economic and technological change, with many of earth's life systems under ecological threat. The major changes which are currently being made in terms of Australia's economic reconstruction are not only necessary, but probably the bare minimum which will be needed, if we are to achieve true economic viability before the arrival of the 21st century.'

Our use of technology in schools seems to be a barometer of our ability to change and accept the new. The barometer reading is not good.

Change is occurring at an unprecedented pace in the 'real' world. Schools seem lost in an authoritarian and conservative world and bright teachers seem eager to leave the system and join a more diverse one. Students face daily a growing wedge between their daily lives and their out-of-touch classrooms.

AN EDUCATION SYSTEM LEADING CHANGE
Dr Ellyard explains that it is the economic system which now wants creative, enterprising, innovative, assertive, lifelong learners with a broad range of skills. The economic system no longer wants docile, unquestioning, narrowly trained, takers of orders. He maintains that we need the creation
and fulfilment of self-fulfilling prophecies in order to realise a preferred future, just as President Kennedy did in 1960 when he set the goal of going to the moon and returning in a decade. Americans did not have the technology to do this. They were forced to discover how to do it by Kennedy’s prophecy.

He (Ellyard 1984) outlines components for education reform to fulfill the goals of economic and ecological sustainability: ‘I believe these are issues that need to be addressed by educators and addressed quickly. I hope that educators will ensure that the coming education system, which will be a lifelong education system, will lead rather than follow rapid changes which will occur over the next decade. I hope that the education system will be part of the solution and not the problem.’ His components include:

- Developing a culture of lifelong learning
- A broadening of learning
- The promotion of learner-driven learning
- More balanced learning
- Learning for creating a positive future
- Learning to think globally
- Learning about other national cultures
- Learning about Asia
- Creating an exemplary education system

He concludes that our education systems are suffering from acute financial pressures. They are therefore restricting expenditures in professional development; minimising new learning; restricting expenditure on new programs; minimising innovation; slowing down recruitment and driving outstanding people away.

“The result is an education system which is not developing new ideas and capabilities fast enough. Education needs a series of radical new approaches to promote new innovation and new skilling in the current restrictive climate.” (Ellyard 1989)

**MACRO-RESTRUCTURING**

More detailed reform measures have been brewing in my mind for some time. These complement rather than conflict with some of Dr Ellyard’s broader reform components. I call this changing of the broader education system macro-restructuring. Although I do not have time to discuss it here, I saw the restructuring of business and our community equally as important. Reshuffling the whole deck of education cards urgently. Piecemeal approaches are not enough. Time is running out. I offer the following smorgasbord of approaches which are by no means comprehensive.

- Students being able to avoid inappropriate teachers or programs of low interest/diversity.
- Students getting in charge of themselves and their learning, lessening teacher dependency.
- Students valuing interaction with each other as an integral part of their learning.
- Commitment by students to understand their own learning processes and how they can improve them.
- Scrapping of rigid timetables and classes for the sake of classes, so that learners can be freer to pursue their interests and skills.
- Teachers doing less talk with quality student discussion and questioning taking larger slices of the school day.
- More student choice.
- Emphasis on learning of academic skills in conjunction with vocational and higher order, entrepreneurial skills — creativity, problem solving etc.
- Strong links between entrepreneurial skills of students and industry.
- Ongoing access to the latest innovations/technologies by all students at all stages of their education, with many opportunities to connect the innovation/technology with their current environment/situation.
- Entry into courses by student commitment to learning and by proven understanding about their own learning.
- Creation of resource centres which link schools with industry and the community, work on public relations for schools, teaching parenting skills, fostering parent participation in schools, displaying the latest technology available for schools and how to use it.
- High standards of teacher education. Continued and supported professional growth of teachers.
- Effective education of the community as to current strategies in classrooms, negating the very simplified ‘back-to-basics’ catch cries. It should be ‘forward to different basics plus higher level skills.’
- Commitment by the community to lifelong learning.
- Ongoing education throughout life with second or third chances in the event of failure. Fuzzier barriers between institutions. Life passports which can include all educational accreditations from five to ninety-five years of age.
- ‘Try Out’ periods for students in their early years so they can experience a wider smorgasbord of subjects/community events. They can then make informed choices as they specialise at an older age.

- The opportunity to become more multi-skilled at an older age.
- Courses to be continually updated and changed to meet real world demands/happenings. Teachers to be regularly changing between industry and education.
- Renaming principals and deputies in schools as learning facilitators and managers. The learning facilitators (the best teacher in the school) to be the highest paid and to be associated with the curriculum and learning. The manager is to be associated with resources, funding, maintenance, staffing etc.

Such changes need to be implemented wisely, taking into account successes or failures of the past. Restructuring means many things to many people and there are many other suggestions around the world as to the way to restructure education. The main point is major agreed changes are required and quickly.

**MICRO-RESTRUCTURING**

I offer the term micro-restructuring to describe ways which focus on kids, classrooms, teachers and technology to
change so that new technology innovations can be accepted more easily in their classrooms. These include:

- A principled teacher
- A multi-skilled teacher
- A friendlier interface
- A reflective classroom
- Tool use of technology
- Children with an ongoing desire to learn
- A culturally aware classroom
- Demonstrations for fellow teachers

Boomer (1988)

- Immersion
- Imagining
- Interaction
- Observation
- Questioning
- Trial & Error
- Commissioning
- Testing
- Celebrating

Cambourne (1988)

- Immersion
- Demonstration
- Expectation
- Responsibility
- Use
- Approximation
- Response

A principled teacher: examples to drive classroom practices

More and more teachers are becoming reflective in examining their role, underlying educational beliefs and subsequent classroom practices. Their classrooms are learning laboratories where everything is under the microscope. Thinking, processes, content are experimented with, evaluated and adapted to suit the unique set of children and the community within which they teach. Their learning programs are rich and content rich.

I believe that a teacher who is aware of the principles behind his or her practices is in a much stronger position to accept change and new technologies in the classroom. These teachers have usually come to examine their beliefs about learning: their own learning and that of the children in their charge. I propose that these teachers are best suited to the use of information technology in our schools.

Teachers enter their first year in front of a class as products of a conservative education system with hidden, intrinsic values and beliefs which have never been articulated. They were taught by teachers who were equally unaware of the beliefs underlying their practices.

These beliefs/values, according to Brian Cambourne—Head of the Centre for Studies in Literacy at Wollongong University—can be described as the 'learning is habit formation' theory of learning (1988). He argues that this theory was at its strongest in the 1940s and 1950s. He suggests:

"Learning is essentially habit formation. Effective learning is the establishment of 'good' or 'desirable' and the prevention of and/or elimination of 'bad'. Habits are formed through association between stimuli and responses. The degree to which something is learned is a function of the strength of the association between stimulus and response. Repetition strengthens the associative bond between stimulus and response." (Cambourne, 1988)

Whether we know it or not, this theory abounds in our schools and is firmly ingrained in the minds of most parents.

Brian Cambourne and Garth Boomer — who is currently Deputy Director-General of Education (Curriculum), Education Department of South Australia—offer alternative, more natural views of learning based on how we learn as human beings in the wider world. They offer multi-sets of principles to drive classroom practices—see Figure 1.

I have personally applied these principles in my classrooms over the years. I discovered that my subsequent practices allowed for the ready use of new technologies by the children. Having adopted the principles, I made them more relevant by changing them—adding new ones and deleting and ones which did not work. I recently clarified my additional principles:

- Connecting
- Metacognition
- Climate
- Challenge
- Ownership

Although I believe all these principles are very important, it is of much greater importance that all teachers articulate their own principles and then truly apply them to their classrooms and their own learning.

It may not be a 'natural' view of learning the teacher is following, and many are realising that classrooms are far from natural learning environments, but at least he or she can be explicit about the learning/teaching in the classroom. At least older views of learning can be identified and changed.

A natural view of learning and computers

How then did a natural view of learning allow technology to be used effectively in my classroom? The major teaching/learning changes after a number of years operating with intrinsic older principles included:

- Viewing children as equal learners in the classroom with the teacher; not jugs to be filled with knowledge.
- The teacher acting as learning facilitator, not preacher.
- The children learning by doing meaningful activities; not just repetitive exercises.
- Time for the activity being controlled equally by the learner and the teacher.
- Learners negotiating more of the activity and being in charge of their learning.
- Making sure content is diverse and variable enough in format and style to allow learners to be challenged at their many different levels and interests.
- Computers being seen as another tool in the classroom to assist learners as they go about their activities.

These changes and others allowed computers to enter the classroom as word processors, database and logo operators, musical instruments and animation tools, etc. Children collaborate and interact at the computer in an environment that has always allowed this to happen.

A multi-skilled teacher

The teacher of the future is one with a multitude of skills. These skills will cross over and connections will be made which make that teacher and that classroom unique. A teacher gaining these skills after school hours or leaving teaching for a number of years and then returning with new, exciting skills will be in a position of great strength for the demands of schools in the 21st century. He or she will be a life-long learner. Teachers hibernating for long periods in schools will become like museum pieces.

Successful users of IT will be able to integrate it with many subjects of the curriculum.
A friendlier interface
Friendly technology is essential for young children to pass the barriers of loading, saving, manipulating their work easily etc. On screen menus, the mouse and easy to use programs all enhance learning.

The future can only hold fewer barriers between the user and the computer. Touch screens, and other similar technologies, will all help the IT classroom.

The technology should follow the very human world that it is in. It should be diverse, creative, exciting, be readily available and match our many needs. We should look at broader definitions of technology as discussed by Sachs, Russell and Chataway. "Technology is the creative response to economic and social conditions and needs. It is manifest in knowledge, procedures and products and can be used to control, improve or change aspects of individuals and society's everyday life".

A reflective classroom
The advanced classroom of the future will be a living laboratory, constantly examining learning and thinking processes, content and teaching approaches. Teaching will be reflective so that the needs of the learners are constantly and carefully addressed.

Tool use of technology
Children and teachers must learn to think of technology as a tool or servant rather than something mystical of which they should be afraid or in awe. They should be familiar with a wide range of tool uses of computers in their own lives and be able to transfer that knowledge to the school environment. They should have a resource person they can tap into for the latest in technological know-how.

Children with an ongoing desire to learn
Many students are leaving our schools with no desire to ever read or write again. Their concept of mathematics is that it is an alien chore which has no relevance to life after school. It is the challenge for teachers to make learning relevant to the outside world. Learning should be enjoyable, teachers should give students life-long strategies for continuous learning.

Schools must be more interesting places, high quality learning should be occurring at all times. As Al Shanker (1990), President of the American Federation of Teachers states, 'Lots and lots of kids are going to college (in the U.S.)—more than in any other country in the world — but they're entering with less, and they're leaving with less'.

A culturally aware classroom
Teachers should have experience in schools of varying social/cultural-economic diversity. We must be ever aware of the diverse needs of these communities and adjust our programs to suit. We should be aware of less privileged communities and give all support necessary in effecting change in schools in these areas.

The community must be globally aware of its place in the ecological and economic world to be able to support the changes in education for their children.

Demonstrations for fellow teachers
We need to offer teachers examples of ways IT can be used in classrooms. I would like to demonstrate some of my own work.

Computers, animation and literacy
Initially, using the micro-restructuring measures listed, I found it easier experimenting with word processing, Logo, drill and practice, adventure games, and communications programs in the classroom. I then followed my interests in graphics, music, drama, language and media by combining children's storywriting with computer animation.

The children have explored new areas of thinking and learning in the language classroom. Their ideas are animated in 4000 ready-to-mix colours. There is language within the story; there is language between the children composing the animation. Co-operative skills are enhanced, higher-order thinking has fewer barriers. The audience is captivated by advanced ideas from young children.

Battling 'Metamorphobia' and getting started
A characteristic which appears to be present to a greater or lesser degree in almost all human beings is a fear of change or avoidance of change. Stephen S. Willoughby, Professor of Mathematics at the University of Arizona calls it 'Metamorphobia' (1990). Great change must be fostered now in our schools.

For both micro- and macro-restructuring in education, our communities must become vitally aware that although making changes in education and IT use in schools is not a cure-all for ills, it is essential just to keep pace with a faster moving world. Education should lead that change, IT should be tool to assist in the process as well as the barometer of the success achieved.

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