

Education in the 21st Century

“The Second Education Paradigm: Welcome to Dinner”

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Occasionally in history events conspire together to bring about fundamental change across an entire social landscape. We are presently witnessing one such event; the complete rebuilding of what we understand education to be. The transition to the second education paradigm is changing education forever, and those countries which recognise this opportunity and have the social and political willpower to make the transition will then dominate the Knowledge Economies of the 21st century. The choice is quite stark: realise the opportunity, invest in it and reap the rewards or pretend that nothing is happening, that change is too difficult and become trapped in an education never-never land and watch as social, economic and Knowledge potential withers and dies. Countries must choose to make the transition and do so knowingly and with a sense of purpose and commitment. Choosing to do nothing is still a choice.

Welcome to the dinner party of a lifetime!

Index:

Introduction	Page 3
The Purpose of a Dinner Party	Page 7
The Wine	Page 9
The Entree	Page 16
The Main Course	Page 27
Dessert	Page 31
Cheese and Port	Page 36
The Guest List	Page 40
An After-Dinner Mint	Page 41

Introduction

The claims on which we currently based our secondary schooling, served a world that many of today's adolescents do not wish to aspire to and is not real for so many of them (Steinberg, 1996). The problem of engagement will become the greatest problem to face our schools, and this is further underlined when it is recognised that non-engagement is a major adolescent malaise. Engagement is in the hands of excellent teachers and inspiring teaching. John Hattie: The Knowledge Wave Conference in New Zealand 2003
http://www.knowledgewave.org.nz/forum_2003/speeches/Hattie%20J.pdf

The purpose of this article is to provide an overarching framework that describes education in the 21st century not as it is but rather what it could be. One of the most successful teaching practices is the use of metaphor and in order to effectively communicate this framework we have used the metaphor of the dinner party. Our first task is to establish the purpose of a dinner party and from there we can then set about deciding what constitutes a successful menu that would meet the purpose of holding a dinner party.

With the advent of the second education paradigm, there are many philosophical, managerial and infrastructural issues that need to be addressed. These need to sit within an integrated strategic plan for education which is both practical in its expectations as well as visionary in terms of its potential. http://www.teachers.work.co.nz/archive_Aug_2004.htm

The menu for this to be successful is set out below:

The Menu for Success

The purpose of a dinner party is multifaceted. On the one hand it is a social occasion, a reason to bring people together in a single place and enjoy each other's company. On the other hand it is also a time for animated and passionate discussion with people holding wide-ranging views across many different topics and interests. It is also a time when the body receives necessary sustenance (and sometimes more than it needs), and it is also a time where the hosts enjoy to share their home with close friends; "their community", and also to integrate new members into that community.

The wine selection is very important as this will assist in setting the palate for the meal. We would recommend a quite heady and recently bottled vintage, based around the cognitivist and constructivist grape varieties with a strong underpinning of values laden fruits providing a soft but rich and enduring aftertaste.

The entree sets the scene for the rest of the meal and for your enjoyment tonight we have a single "second paradigm" entree which may appear a very simple fare on its own but when we add to it the PD sauce, the result is a taste that your palate will never forget.

The main course will provide the essential framework for the remainder of the meal. The main course tonight will be based around an "essential competency pie" which is a departure from the traditional main course of boiled skills which has a tendency to be somewhat dry and leaves a rather bland aftertaste in the mouth following the meal and has a tendency to be quickly forgotten. The main course may take some years to fully digest and we recommend strongly that you do not rush this course and that you enjoy the fresh accompanying "content" vegetables picked from the local garden.

Dessert is a very rich multilayered gateau including a sweet but stable selection of hardware biscotti layers separated with Ministry/Department of Education advice flavoured liqueur cream topped off with a soft[ware] and enticing meringue. This is accompanied by a light infrastructure fruit salad and served with lashings of interoperability gelato to provide a refreshing compliment to the sweet gateau. There is also a selection of rich ICT sauces that patrons can add to suit their own taste.

Cheese and Port conclude any good meal and these leave a pleasant memory in the mouth. Please ensure that the meal is not overwhelmed with this final course but rather that it compliments and encourages the meal, allowing the patron to leave with a good taste in the mouth and a feeling of having partaken in a successful dinner party. We suggest a mixture of assessment cheeses and a glass of [re]Port[ing] that has matured well and has a rich flavour but carries a softness that does not overwhelm the meal just enjoyed.

The Guest List defines the success or otherwise of the dinner. In the past not everyone was invited to the dinner. Only people who appreciated the finer things in life were invited. For this dinner everyone is invited. If the community of patrons is pleasant, amiable and there is a consistent focus on the purpose of the dinner, then dinner can be an enjoyable time, not rushed, but with each course savoured and enjoyed for its own sake, but at the same time each course contributing to the overall sense of a satisfying meal. A successful dinner should be punctuated by animated and passionate discussion with a wide variety of views expressed but at the conclusion of the meal each patron goes away having contributed to the discussion, they have felt listened to, and so can depart with a warm afterglow that transforms a mere dinner into a sumptuous banquet with everyone looking forward to the next time they meet.

An After-Dinner Mint provides a fresh and vibrant flavour in the mouth. The purpose of the mint is not for sustenance but rather to refresh and inspire; it is small but it is the taste you leave the dinner with.

"But, alas, none of these achievements makes us better men. There is no equation between bank accounts and goodness of heart. Knowledge is by no means the same thing as wisdom or nobility of spirit... The world has never seen before such an immense army of educators at work on the youth of the country, nor has there ever been before in the history of the world, such a generous outlay of money for education, both lower and higher. The total effect, however, is disappointing, and misses the central point. Our institutions of learning produce some good scholars and give a body of scientific facts to a great number. But there is a pitiable failure in the main business of education which is, or should be, the formation of character, the culture of the spirit, the building of the soul."

- Jones, Rufus M., *The Need for a Spiritual Element in Education*, World Unity Magazine, October 1928. [quoted from <http://laluni.helloyou.ws/netnews/bk/intellect/inte1007.html>]

The Knowledge NET Environment

High order thinking, gaining understanding, knowledge construction, and high level questioning skills are all prime objectives of the current learning scene. The three main components include the school Internet web site, intranet and the shared intranet (extranet) for a cluster of schools needed to be melded together in a sound system that is both simple to use and effective in its support of the learning objectives identified throughout this paper.

In frustration that no such integrated environment existed in 2001 we teamed up with a specialist web database management company (Dataview Design) to build such an environment and the Knowledge NET is the result. A Knowledge Net has since become a generic term describing the integration of internet/intranet/extranet environments even though it is the name of the product we have produced and have subsequently licensed Dataview to distribute in New Zealand.

In order to communicate, exchange ideas and work collaboratively on building conceptual frameworks of understanding via knowledge construction and clever higher order, open, fertile questioning, it is necessary that schools have an effective knowledge building software environment built into their ICT infrastructure. These structures must be simple to use, require only rudimentary technical skills but have the capability for providing powerful learning. The need for such a solution to the issues identified above was identified in 2001 and the Knowledge NET is the culmination of three years of research and development which focused on developing such a solution.

The creation of an effective school Internet web site, intranet and extranet environment requires these three powerful tools to be integrated, rather than three separate elements that need to be created and updated separately. Early on in the project it also became obvious that not only did the school require an Internet web site, the school intranet and a cluster extranet but that each student and each staff member also required the own personal intranet and that in order to carry out effective research students needed to work from a cut down version of the Internet; their own virtual research zone.

Early on in the research process a web based solution seemed to provide the perfect answer with the additional benefits that schools would not require any additional technology, or a high degree of technical skill and the data would be hosted by an ASP service (an application service provider (ASP) is a company that offers individuals or enterprises access over the Internet to applications and related services that would otherwise have to be located in their own personal or enterprise computers.). The difficulty then came in teachers creating web based content that did not require complex web editors such as Macromedia Dreamweaver or Microsoft FrontPage. Early trials showed that expecting teachers to be able to use such programs was impractical. The invention of the What You See Is What You Get (WYSIWYG) editor which was subsequently embedded in most web browsers suddenly made it possible to create rich content on the Internet without needing web editors such as Dreamweaver or FrontPage.

The Knowledge NET research team refined and improved this emerging technology and built an extremely powerful, highly intuitive integrated Internet, intranet and extranet environment coupled with a complete set of research tools for both teachers and students which would allow the second education paradigm to be effectively and efficiently delivered at a cost that was affordable by all schools.

During the research the following tools were identified as being essential elements in an effective and integrated Web based environment. These tools included:

- An effective student-centred search engine which provides a searchable database of recommended sites (7000+) and return reviews that guides students to the most appropriate material. The search engine needs to be configured so that it returns generic wide ranging material or specific content. The research section also needed to include a suite of online encyclopaedia information, the best newspaper's, dictionaries, thesaurus, quotations, maps all in one easy to search environment.
- The capability for content to be added to the site without any knowledge of HTML and with no knowledge of file structures.
- The environment need to contain effective communication tools that would allow schools to add discussion forums, calendars, polls, chat sessions and electronic portfolios.
- Effective tools which encouraged communication between the teachers within the school and other schools within their cluster as well as the able to create classrooms, subjects or interest areas across the entire cluster of schools. The site must also facilitate effective communication between teachers and students in both the local school environment and extended cluster environment. The software must also facilitate effective communication between teachers and their parents/caregivers.
- The software must be able to create links the standard school software files, create links to web sites, other internal content, and e-mail software in a structured and managed manner so that teachers and students can access all of their filed material from any Internet capable computer, anywhere.
- Teachers and administrators need to be able to manage security of the material that they produce by allocating rights to different users of the material.
- The logon and username of each user should dictate what the user sees on their screen and what they are able to access. The environment should be fully customisable, providing schools with a powerful but intuitive and user-friendly interface.
- Teachers and students should be able to create shared working spaces quickly and easily, as they are needed so that they can share information with each other quickly and easily no matter where they are.
- The capability to make use of Digital Learning Objects along with already created web based content made available by web sites from around the world. Within the Knowledge NET you can simply "cut and paste" or "drag and drop" content from any web site (where (c) permission is given) into the Knowledge NET and found that information editable and available instantly.

These are just some of the requirements that the Knowledge NET and now deliver in your school.

The knowledge NET environment is the perfect vehicle for allowing a constructo-cognitivist approach to education to blossom, as it allows teachers to create rich education resources which underpin the open, high order, fertile questions that teachers have always wished they could ask and subsequently resource. The ability to provide students with such a huge library of customisable resources opens up the possibility for the delivery of the second education paradigm in any school, anywhere.

Chapter 1: The Purpose of the Dinner Party

So what is the purpose of having dinner with a group of friends? You could of course have dinner on your own and for that matter the meal could be quite bland and it would still meet all the dietary requirements that your body required, but it would not be a particularly pleasurable and satisfying experience. Get any group of people in the same environment and immediately you have a variety of opinions, ideas, philosophies and personal worldviews of what education should and could be. Being human beings, these worldviews are not always as sensible and logical as you may expect.

Martin Luther King in 1947 had this to say in regard to the purpose of education:

"We must remember that intelligence is not enough. Intelligence plus character--that is the goal of true education. The complete education gives one not only power of concentration, but worthy objectives upon which to concentrate. The broad education will, therefore, transmit to one not only the accumulated knowledge of the race but also the accumulated experience of social living."

http://www.stanford.edu/group/King/publications/papers/vol1/470200-The_Purpose_of_Education.htm

Being "intelligent" is all very well, being able to access and use vast information and communication resources is useful, being able to be critically literate is impressive and being able to synthesize and distill new knowledge is powerful – however, all these traits were shown by a small group of people who flew two planes into two large buildings, killed thousands of people and changed the world forever. The purpose of education must extend beyond purely clinical outputs; it must contain an ethical underpinning and promote values that we can aspire to as a community especially as society increasingly take on a more and more non-sectarian philosophy, for in our every-busy lives where else are our children going to obtain an education in what is right and moral.

The Knowledge NET provides a rich collection of information and communication tools and processes which allow for significantly increased capability of students to create knowledge and understanding and for the teacher to provide the necessary content and inspiration for this to happen. Increasingly the education system and all its members have a moral responsibility to accompany that knowledge and understanding with a framework of agreed on values and ethics in order to provide our young people with a framework to guide the use of their new-found knowledge and understanding.

The purpose of education is an expressed goal; an outcome that we would desire for all citizens, not just children. We could debate forever the purpose of education but in order to be serviceable, the defined purpose of education needs to be succinct and inclusive and for that reason we have developed the following definition based on a number of readings:

"The purpose of education is to provide each member of society the capability to contribute to the collective goals, (philosophical, idiosyncratic, practical and social), of that society where these goals are based around the accepted values of the community and that those goals and values are based on the historical and cultural wisdom of that community".

As you can see we then get to defining culture, wisdom, what the goals should be and what are acceptable values. If you would like more background reading on this then you may like to read the essay on wisdom written earlier in the year

[\[http://www.teachers.work.co.nz/archive_July_2004.htm\]](http://www.teachers.work.co.nz/archive_July_2004.htm) .

Debate on this is very necessary and should not be disregarded as it forms the fundamental notion of what education will be within each community. Therefore, by definition, it is necessary for the Department/Ministry of Education to ensure that the education system allows for the local, identified values and goals to become embedded in the delivery of what we call "education". In other words education should be flexible and capable of meeting local needs. This of course relies on the acceptance of individuality but at the same time acknowledges that no generic system no matter how localized will deliver exactly what each individual learner requires at any given point in their learning continuum, no matter how carefully we try and meet the local needs.

There was a time when the "use-by date" for knowledge was counted in centuries but now it can figure in days and months; even moments, especially for scientific and research based knowledge. That we can potentially know more now than ever before is beyond doubt but access to knowledge and the capability to process, manage and apply it is not equitable. In order to make this socially equitable, the essential competencies to build understanding when it is required, together with the capacity to be a lifelong learner, must be available to all. That is one of the prime functions of the public school system; to ensure that every learner is provided with the same opportunity to make of life what they choose, what or how they choose to do with that potential is an individual's choice but the capability must be available to all. One of the roles of schools is to even the scales and make sure that all are using the same judgment weights.

Three hundred years ago the first modern education paradigm was brought into play through the invention of the printing press, and knowledge became more available as the price of "knowing" reduced considerably and accessibility to information increased dramatically. The first modern education paradigm enabled far more people to "know". In the 21stC the second modern education paradigm is emerging where the cost and accessibility of knowledge is such that we are overwhelmed by it; so much so that as educators we can see the potential not just for everyone to have the possibility to "know about the world they live in" but that everyone has the potential to **understand** the world they live in. Suddenly the purpose of the dinner is not just to consume food for survival but rather to appreciate the food, the company and enjoy the event and to leave fully satisfied: intellectually and emotionally.

The second education paradigm has arrived and it will continue to revolutionise our society, but just as the first education paradigm took time to permeate all levels of society and government, this one will too. But the choice to take on the second education paradigm is not linked to a technology (the printing press) that was slow to replicate or to be heard about in far off lands; this technology is here now for all to see but for many, the Emperor's clothes look just fine as they are. However **the Emperor has no clothes!**

There are no boundaries, there are no limits and as the Nike© advert says "passion has no volume control" so lets turn up the volume and deliver the second paradigm. The purpose of education has not fundamentally changed but its processes underpinning its delivery and its focus has changed forever. The following chapters describe those changes.

Chapter 2: The Wine

There are numerous education philosophies that we could tap into and use but not all are based on the premises that underpin the **first** education paradigm.

[http://www.teachers.work.co.nz/archive_Aug_2004.htm]

It is therefore important that we select a philosophical model that is in keeping with the emerging second education paradigm. There are numerous teaching strategies and processes and an equally vast number of learning strategies and processes which could be encouraged and be brought into being by the teaching fraternity so the overarching philosophy must accommodate an extraordinarily large set of permutations of these teaching and learning toolsets.

Gwen Gawith, in a recent article under the heading "Learning for Meaning" in the journal "Good Teacher" [Term 4 2004 <http://www.ed-media.co.nz/>] presented a quite insightful statement:

"While teachers often shy away from theory, the point I am making becomes a lot clearer if you examine it in the context of theory>pedagogy. In short, the recent marriage between cognitivist and constructivist theory has given rise to a rich pedagogy (the science and art of teaching and learning) which represents research based support for concrete strategies for turning the rhetoric of "teaching for meaning" into the describable, measurable reality of "learning for meaning".

This marriage between cognitive and constructivist education theory has appeared to materialise out of nowhere over the past 10-20 years flying in "beneath the radar". In this marriage (cogno-constructivist or if you like constructo-cognitivist), the two partners both bring strong theoretical as well as practical based research to the union and in the process provide a powerful overarching philosophical base that could underpin the emerging second paradigm.

Research in neuropsychological brain mapping has come along in leaps and bounds in the last five to 10 years as new technologies such as fMRI have been developed.

[Cognitive Neuroscience: Implications for Education

http://www.brookes.ac.uk/schools/education/staffinfo/CWSE_26_1_02lores.pdf!]

This brain mapping process allows us to more accurately peer inside the brain while its human owner carries out a range of tasks. Much of this research is rewriting our fundamental understanding of how the mind works the nature of consciousness and it is also directing educators as to how they can apply this new understanding to improve classroom teaching and learning practices. As a relatively new area of research it holds the promise of providing us rich quantitative research in regards to learning as well as rewriting previously held anecdotally and mostly qualitatively based theories.

Teaching students "thinking skills" has become a feature of 21st education practices however most teachers have taken the atomistic approach to thinking skills, teaching the use of individual thinking skills tools rather than the overarching thinking process. A common example of this is the teaching of de Bono's "Six Thinking Hats" program and having this being presented as if it were teaching "thinking skills". The "Six Thinking Hat" program is an excellent tool but it is not an overarching view of thinking but rather a particular cognitive tool used in particular situations to develop particular thinking habits.

Art Costa and Bena Kallick have written some considerable work on developing "Habits of Mind" [<http://www.habits-of-mind.net/>] which describes different types of intelligent behaviours (such as assisting, metacognition, questioning, risk-taking, communicating and they refer to these as "habits of mind" but this still does not present a complete overarching view of thinking which teachers can then use and apply as necessary. Four years ago Teachers@Work (http://www.teachers.work.co.nz/archive_May_2002.htm) did a literature review on this topic and over the course of 18 months developed a thinking model that has been adopted by a number of schools which we will briefly outline here.

Defining thinking is a considerable academic challenge but in order to progress this overview we will define thinking as "the process which contributes to the reinforcement or the iterative changes that occur to a person's world view". If this is a reasonable definition then we then need to investigate how our world view is built, and how it can be reinforced and modified. This is the fundamental crux that underpins all teaching and learning processes and for this reason it is critical that students understand thinking in order that they can reflect on their own thinking processes (metacognition).

Briefly; the model contains six elements that contribute to a persons continually changing worldview [http://www.i-learnt.com/Thinking_What_is_2.html].

These intricately intertwined elements are discussed by a wide range of cognitive researchers, from which we have created a simplified flowchart. This flowchart, containing the six elements demonstrates the main interrelationships. The main contributors whose work we have used to develop this flowchart includes Marzano, Vygotsky, de Bono, Swartz, Browne, Papert, Dunlop, Grabinger, Dugoid, Collin, Campione, Brandt, Hughes, Harpaz, Lefstein, Jones, Presseisen, Rankin, Suhor, Bloom, Jonassen, Costa

1. **Initiators of thinking:** needs/wants/desires; imperatives; discourse; reflection (metacognition); mystery/intrigue; observation(s); communication; (oral/written/visual); opportunity; inspiration; high order thinking questions; competition; inflammatory/radical statements; purposeful research; serendipity*; interaction(s)
2. **Thinking Processors:** Creative Thinking; Critical Thinking; Metacognition; Values/Culture/Spirituality; Problem Solving; High Order Thinking Questions
3. **Facilitatory Environments:** Context; Construction; Collaboration; Conversation/Communication; Information . . .
4. **Thinking Skills Processes:** Information Gathering Skills; Generating Skills; Focusing Skills; Remembering Skills; Analysing Skills; Integrating Skills; Evaluation Skills; Organising skills
5. **Facilitatory Tools:** Goal Setting; Brain Storming; Peer Tutoring; Conferencing; Concept Maps; Mind Mapping, Webquests; Microquests; Study Groups; Concept Scaffolding
6. then there's **Human Nature:** This is a selective/irrational and passionate filter which means that even after rational processes are employed, final decisions often dismiss the preceding thoughtful processes and then unbelievably dumb decisions are made on a reasonably regular basis!

The model that follows is a greatly simplified model and as such it should be noted that:

1. All models are fraught with assumptions and simplifications and by their very existence are flawed; BUT they are useful.
2. The way we behave (as a representation of our thinking/thought processes), is very dependent on the cultural setting we find ourselves in. i.e. how we behave in an academic

environment, how we behave in our home environment, or on the sports field, are often very different.

3. We are not robots and by our very nature, as human beings, we are passionate, silly people who are fantastically varied and very interesting creatures to study!

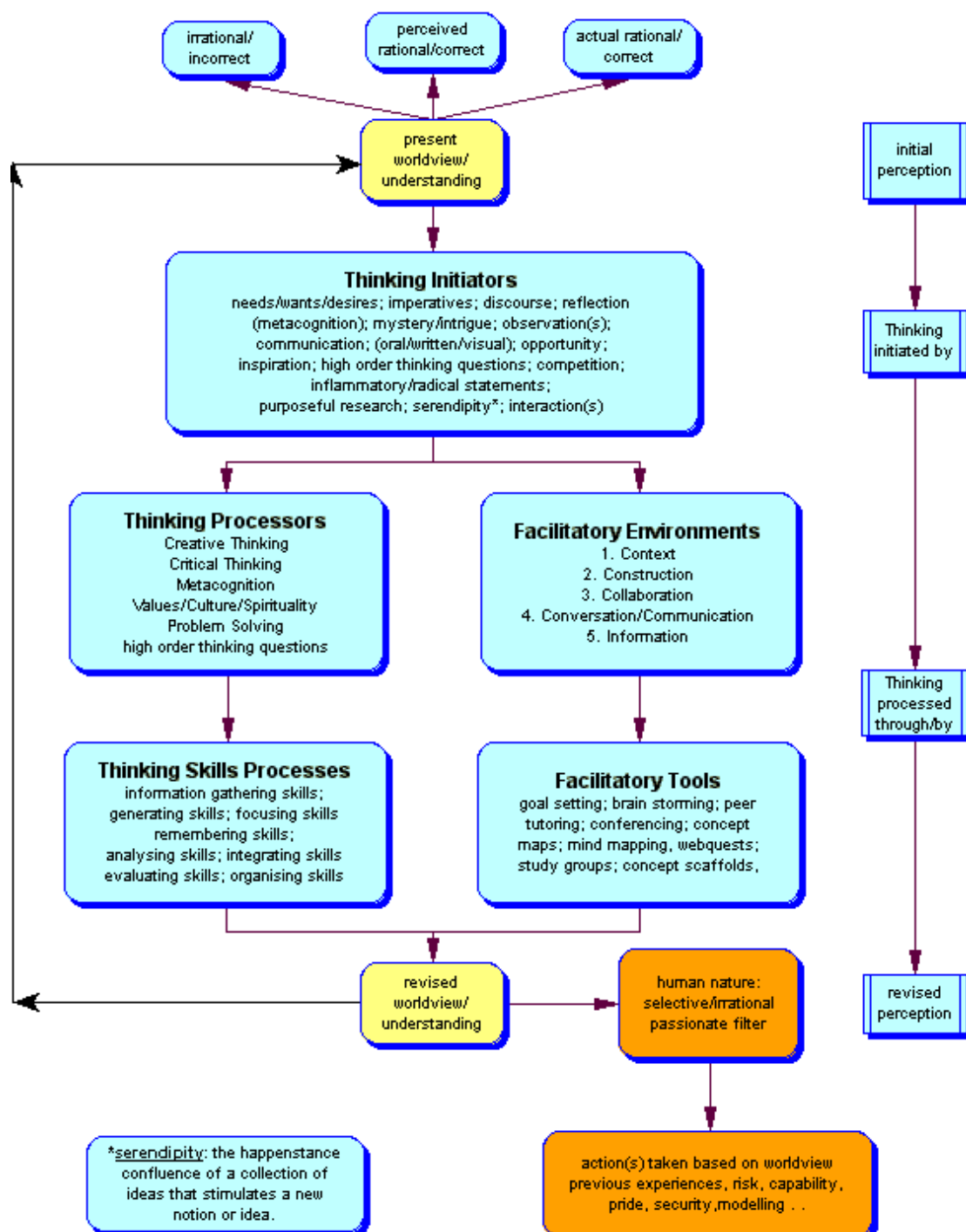


Diagram 1

Teaching & Learning Philosophy: Constructivist theory came to the table in the 70's and 80s but was dogged by attitudes of senior educators that as a concept it was a soft option, applied to justify teachers who could not control student behaviour and where students ran

the classroom in the absence of any structure. Recent refinements and a more disciplined set of parameters surrounding "constructivist theory" have led to a renaissance of "constructivism" but many misunderstandings of the concept still survive. In an excellent article by Martin Brooks and Jacqueline Grennon-Brooks the two authors identify five central tenets of constructivism [Grennon and Brooks, 1993]¹

"The search for understanding motivates students to learn. When students want to know more about an idea, a topic, or an entire discipline, they put more cognitive energy into classroom investigations and discussions and study more on their own. We have identified five central tenets of constructivism"

- *First, constructivist teachers seek and value students' points of view. Knowing what students think about concepts helps teachers formulate classroom lessons and differentiate instruction on the basis of students' needs and interests.*
- *Second, constructivist teachers structure lessons to challenge students' suppositions. All students, whether they are 6 or 16 or 60, come to the classroom with life experiences that shape their views about how their worlds work. When educators permit students to construct knowledge that challenges their current suppositions, learning occurs. Only through asking students what they think they know and why they think they know it are we and they able to confront their suppositions.*
- *Third, constructivist teachers recognize that students must attach relevance to the curriculum. As students see relevance in their daily activities, their interest in learning grows.*
- *Fourth, constructivist teachers structure lessons around big ideas, not small bits of information. Exposing students to wholes first helps them determine the relevant parts as they refine their understandings of the wholes.*
- *Finally, constructivist teachers assess student learning in the context of daily classroom investigations, not as separate events. Students demonstrate their knowledge every day in a variety of ways. Defining understanding as only that which is capable of being measured by paper-and-pencil assessments administered under strict security perpetuates false and counterproductive myths about academia, intelligence, creativity, accountability, and knowledge."*

Marrying constructivist notions with our understanding of cognitive theories should result in a "best of both worlds" scenario as constructivism supplies the broad environmental landscape (pedagogy) and the cognitive sciences provide the science (epistemology) that underpins the learning, and directs the teaching processes. In clearly defining that we wish to deliver the very best teaching **and** learning in our schools we are in a much better position to induct into our communities citizens that have a set of competencies that are far better aligned to 21st-century demands.

A reminder here: Any teaching and learning philosophy that does not take into account the nature of what it is to be human: that we are irrational, passionate and silly people rather than the often assumed (in educational theory) logical, sensible and rational, is based on a

¹ Unbelievable URL here!

http://www.ascd.org/portal/site/ascd/template.MAXIMIZE/menuitem.459dee008f99653fb85516f762108a0c/?javax.portlet.tpst=d5b9c0fa1a493266805516f762108a0c_ws_MX&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journaltypeheaderimage=%2FASCD%2Fimages%2Fmultifiles%2Fpublications%2Felmast.gif&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_viewID=article_view&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journalmoid=e382d6e9c5eaff00VgnVCM1000003d01a8c0RCRD&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_articlemoid=48c2d6e9c5eaff00VgnVCM1000003d01a8c0RCRD&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journalTypePersonalization=ASCD_EL&javax.portlet.begCacheTok=token&javax.portlet.endCacheTok=token

false set of premises. There is nothing wrong with being logical, sensible and rational and there are times when this is absolutely critical and to be encouraged, but the very people that fascinate us and that we enjoy to interact with are the passionate, the sometimes silly and the ones that question everything, who often appear to be somewhat irrational, continually testing the boundaries and questioning the norms!

Within this new framework we can begin to examine teaching practices that can synchronise with what we understand to be the way in which children learn best, noting that no two students learn in the same way, at the same place, across the same disciplines, with the same enthusiasm, with the same talents and gifts. Also, with young people there is a tendency for every day to be a new day, with students bringing with them different attitudes to learning depending on a host of social, physical and emotional cycles and influences brought into the school community from their greater family and wider social community.

There is a global trend towards this philosophical skeleton being given some "substance" through the delivery of essential competencies within a curriculum framework. This is a significant improvement on the previous focus on key skills, broadening the concept of skill to include "contexts that include cognitive and practical skills, as well as the knowledge, attitudes, values and motivation required in a particular context"

[\[http://www.tki.org/r/nzcurriculum/docs/CompetenciesDiscussionPaper.doc\]](http://www.tki.org/r/nzcurriculum/docs/CompetenciesDiscussionPaper.doc)

One of the foci of the application of essential competencies is the need to reconcile the competitive dimension of education which highlights excellence and individuality with the cooperative dimension of education that highlights equity, tolerance and social justice. These are not mutually exclusive and a range of competencies will be developed that both encourage and develop these sets of identified attributes.

Various reports have supported the implementation of essential competencies as a more balanced measure for reflecting the purpose of education. This will be discussed in more detail when we look at the main course later in this article.

While on the topic of education philosophy it is important to make mention of the global trend towards education processes being increasingly aimed at delivering "workplace skill sets". The purpose of "primary education" is not just the creation of a skilled workforce just as the purpose of the meal is not just to provide the body with sustenance. Many educational academics still argue that the transition from skills based education to competency based education institutionalises the "imperative of work" as being the keystone to education especially in the tertiary sector. The second education paradigm however has a far more balanced view of education, reflecting necessary lifelong skills in the context of the development of cognitive/academic capability and the necessity for skills to be developed in our young people that empower them with the capability to become competent and confident citizens in a complex world.

The bottom line when it comes to effective teaching and student learning is the quality of our teachers. No matter what the cost, we must encourage our best, our brightest and our most passionate to take up this mantle and inspire and encourage our young people, through a diverse and appropriate range of teaching strategies, through a curriculum that is relevant and where simplistic testing strategies are not the measure of success. . . . because the social and financial cost of not doing this greatly exceeds any disaster we can imagine. Disengagement with schooling is reaching epidemic proportions and is spreading virally from the large "first world" cities to the small towns of the "third world" and unless we address this urgently, the social and economic cost will be catastrophic.

The Inquiry Learning Process:

The inquiry method of teaching and learning is built on some of the principles espoused by John Dewey who asserted that children are natural learners and are naturally curious. From the New Zealand web site "living heritage" [<http://www.livingheritage.org.nz/started/inquirylearn.shtml>]

"Memorizing facts and information is not the most important skill in today's world. Facts change, and information is readily available – what's needed is an understanding of how to find, make sense of, and use relevant information for specific purposes."

Inquiry learning begins with an essential or key question that is: either proposed by the teacher, negotiated between the teacher and students or proposed entirely by the students themselves. Setting an essential or key question requires a good working knowledge of how to set effective, motivational questions which will open up a topic for students to explore. However, for the students to successfully answer the key question it is important to either provide or negotiate with them, a collection of subsidiary questions that will enable them to build knowledge and concepts necessary for them to answer the essential or key question from an informed position.

Once the essential or key question is set and the subsidiary questions negotiated the students will need to decide how they are going to answer this question. They could for instance, put together a strategic plan that would include the resources and processes required to gather the appropriate knowledge, and create the conceptual framework that will be required in order to answer the question. They will also need to focus on how they are going to share their newly found knowledge with others. This will in turn frame up what sort of resources they will have to create in order to share the knowledge and understanding effectively with their chosen group.

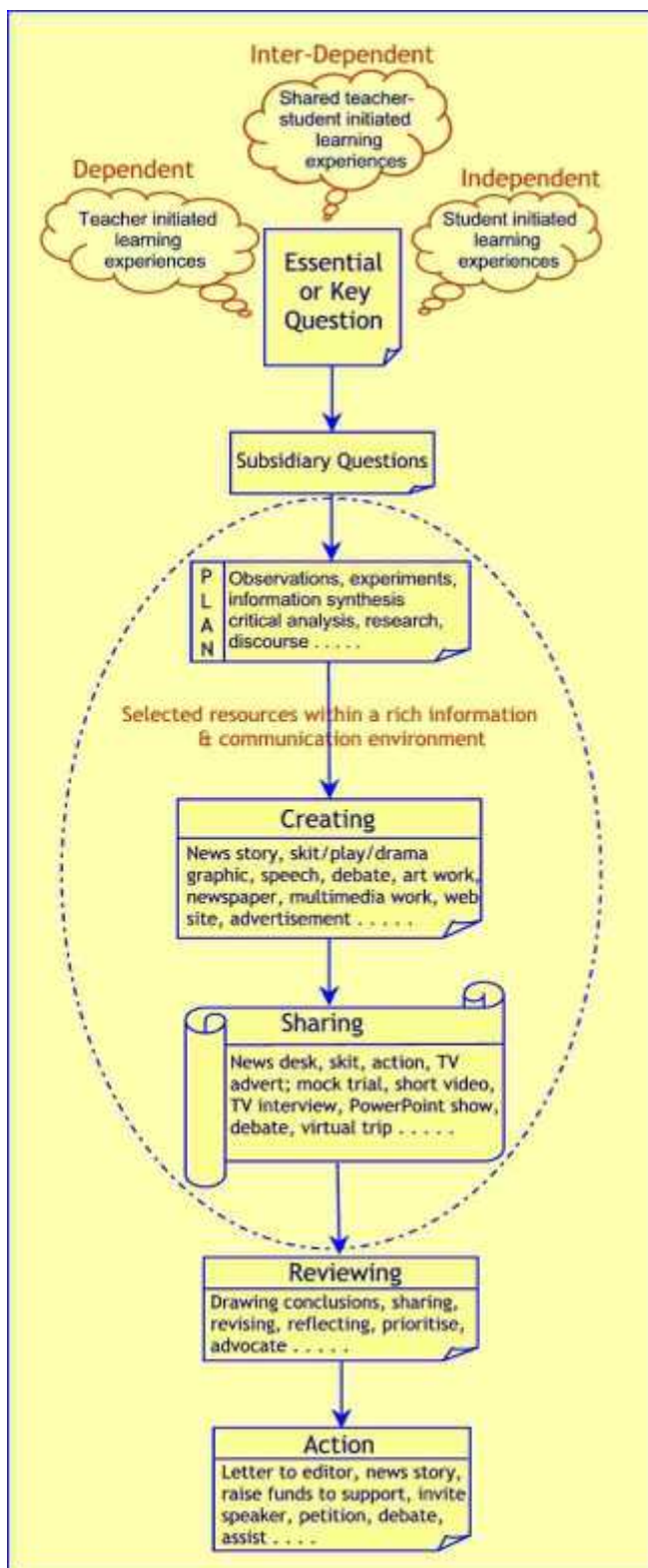


Diagram 2

The questioning issue is one of considerable concern. Setting questions which are:

- Effective,
- Fertile (stimulating and motivational),
- Clever, high order (according to the
- Using a taxonomy to provide a range of questions such as the Modified Blooms Taxonomy [http://www.i-learnt.com/Paradigm_Questioning.html],
- Connected (contextual to the student) or
- Open questions (without necessarily a right or wrong answer),

is an art, and to begin with it would be desirable that the teacher set some sample questions while at the same time setting aside some class time to ensure that students build up their skills in this area.

“The ability to pose questions to understand ourselves and our world is at the heart of what it means to be human. Unfortunately, this essential human trait is distorted in many schools by an answering pedagogy: When questions arise, knowledgeable teachers ask the ignorant students questions primarily in the form of an examination.” Yoram Harpaz and Adam Lefstein: **Communities of Thinking**. Go here to download this article.

[<http://www.learningtolearn.sa.edu.au/Colleagues/pages/default/harpaz/>]

Within the knowledge NET teachers unable to encourage discussion through the forums that are available as well as provide access to wealth of fully searchable Web based multimedia resources in order that they can construct a fuller and richer understanding of the concepts being caught. It is not just the resource content that is critical to the success of student research but also the capability of the student to access information through the ability to ask the right question. Without a doubt, the question is the answer! Being able to provide environment which encourages good questioning is pivotal in the inquiry Learning process in the Knowledge NET provides just such an environment 24 hours a day, 7 days a week, 365 days a year.

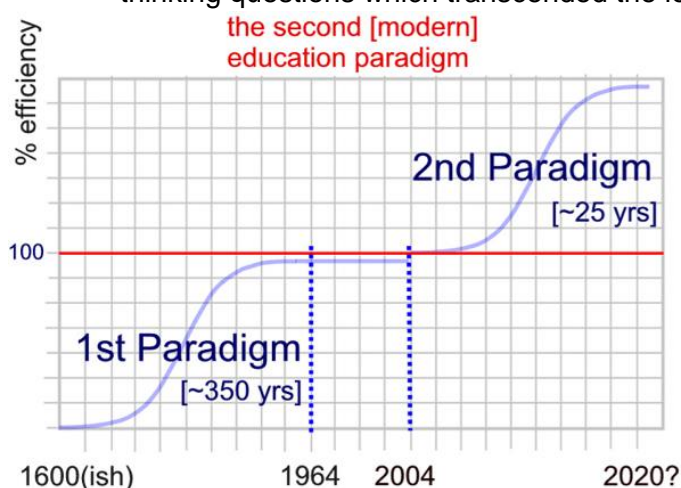
Chapter 3: The Entree

For some time now we have been discussing the advent of the second education paradigm, brought about by the transition from a world where information **and** communication systems were rare, expensive but reliable to a world where the information and communication landscape has dramatically altered and where both come in a wide range of formats/genre and both are now overwhelming in number, depth and quality (with an equivalent variability in all these aspects) and as well as being cheap, they require a new raft of skills in order to be used and managed effectively. This transition has birthed the potential for many of our lifelong dreams about education to become realisable, both practically and economically.

The above paradigm shift has spawned a wide range of tangible educational transitions which were possible in the previous paradigm but unfortunately many were impractical, relying heavily on the teacher constantly re-inventing the wheel, individually creating rich content for their students to interrogate and work with. Teachers were required to create this rich content as the library was unable to resource clever, rich, open, fertile, high order thinking questions which transcended the low-level thematic topics such as space,

earthquakes, the undersea world, dinosaurs musicians/mathematicians/scientists of historical consequence, . . . which could be resourced from the local library as there were 29 books on these topics in almost every school library in the world.

Clever, rich, open, fertile, higher order thinking questions which encourage an education endpoint of understanding rather than just knowing, requires rich resources that make use of numerous media formats, are available 24/7 and can be manipulated simply and easily in a rich web based teaching and learning environment.



The upper limit hypothesis was proposed back in the 1990's by Robert Branson who built on the work of C S Smith in the 1980's. Branson identified three very specific elements that would be required for systemic change

Three key elements must be in place to provide the basis for major education improvements.

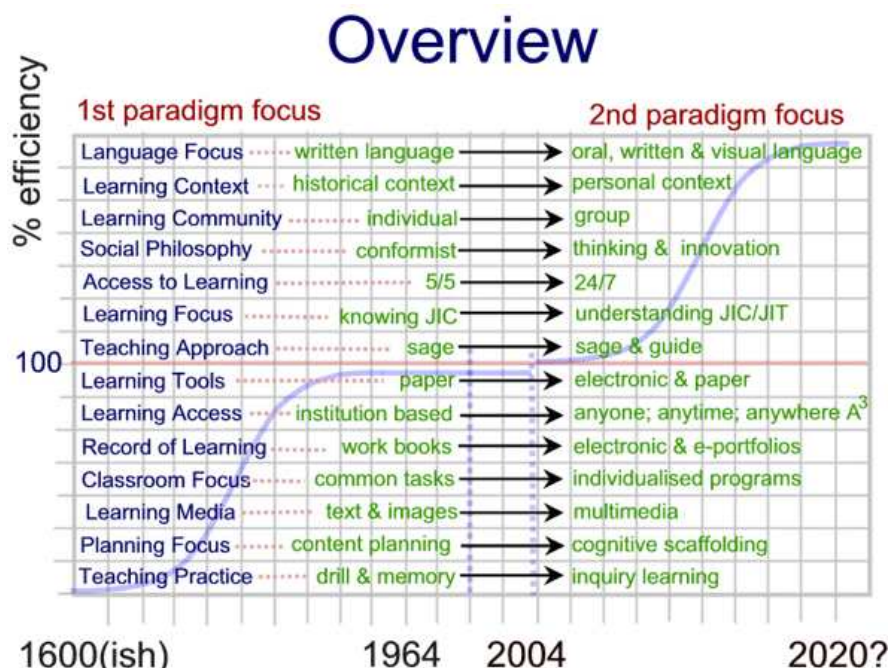
First, there must be a base of valid knowledge of the kind developed by Semmelweis and Pasteur. Second, there must be an organizing process to convert basic knowledge to theory and identify the causes and effects. Third, the knowledge and theory must be incorporated in a learnable technology and disseminated to practitioners for implementation (see Perelman, 1989).

This paper is an attempt to provide "valid knowledge"; develop that theory into identifiable causes and effects and then identify the appropriate delivery technologies.

It should be remembered here that as with any new technology paradigm, such as education (technology: any collection of products, systems and environments that meets the needs or opportunities of a community), as the second paradigm first emerges it is by default inefficient while it puts down its roots and gets established in its new environment. The new environment will require political, academic and public goodwill in order to blossom.

However this transition is just one of many which accompanies the adoption of the second [modern] education paradigm. Additional transitions are highlighted in the diagram below: Additional background on the adoption of the second [modern] education paradigm can be found at [\[http://www.teachers.work.co.nz/archive_Aug_2004.htm\]](http://www.teachers.work.co.nz/archive_Aug_2004.htm)

The arrival of the second education paradigm will bring about a vast range of changes to the teaching and learning which takes place in our schools and also in our day-to-day lives. The major teaching and learning transitions are summarised in the diagram below.



Language Focus: In the first education paradigm the focus for all students and schools was written language (reading and writing). The teaching of oral and visual language was minimal and was considered a minor aspect of the school curriculum while writing and reading dominated almost every activity of the day in schools. In the second education paradigm the importance of a good degree of capability in oral language is taken far more seriously. Oral language is possibly one of the most important skills which a person must develop in order to be successful in almost all aspects

of their world. Without oral capability our children are never going to form, develop or enjoy lasting relationships in any areas of their world. The emphasis of the second education paradigm is on having a balance of appropriate oral, written and visual language capability.

Learning Context: Within schools the context for any given unit of work has been primarily historical. Units of work have always been taught on Romans, space, the undersea world, plants, World War II poetry, algebra, social structures These contexts were almost never questioned and much time and effort has been put into developing resources to meet the needs of these standard units of work.

A student, having completed a unit of work on Romans and who has passed with a satisfactory or better grade would have no idea what it would be like to be and 11, 13, 15 - year-old person in Roman times. They would have no idea as to whether they would sleep in a bed, share a bedroom with other people, whether the bedding would be mats, quilts or blankets, whether breakfast would include cornflakes and come to that: would it be served in a bowl? And is a chariot about to come past nine o'clock to whisk them off to school; and then what subjects would they do at school, what games would they play during morning tea, would they need to take their lunch and where would they take your girlfriend on a date?

This is the world that the child lives in now and in order to build a conceptual framework around Roman life that child needs to know what it would be like to be their age in this different culture. As it is we're taking that child back 2000 years, to a different country which they have never seen before, to a different culture which they have never before experienced and this is the same child who struggles with the concept of "after lunch". The contexts that are chosen need to begin from a personal basis and grow from there in order to provide the best possible chance that the overall conceptual framework can be gradually built in the students mind.

Learning Community: In the first education paradigm the learning community was almost solely based on the individual. It was important for the individual to succeed, there was little sharing of work, assessments were based on the individual's capacity to replicate prior knowledge, whereas in the world today the social place, the workplace and play place predominantly function around groups of people. The second education paradigm encourages a balance between independence and interdependence. This balance will be different for each child but all children need to have the capability to work, socialise and carry out the range of tasks within the group situation in order to be successful in a 21st-century community.

Social Philosophy: The social philosophy within the first education paradigm was about performing to a set pattern of behaviours and norms. People who stepped outside the norm were frowned upon and strong social barriers were put in place to limit this "aberrant behaviour". In the second education paradigm the emphasis is about being innovative, about using the power of the imagination to be different, to ask questions and challenge contemporary understandings and beliefs. While this can become quite frustrating for some teachers in the classroom, today society depends on "thinking outside the square" and people making unique and innovative combinations of ideas, systems and products.

Access to Learning: Historically within the first education paradigm access to learning has been through an institution based on a five hours a week day five days a week program (5/5) whereas learning today is increasingly acknowledged as being a 24/7 experience. Learning can take place in a wide range of environments and situations and no longer willing community identify the institution called school as the only place where learning takes place.

The Learning Focus: The focus of learning in the past has been on developing knowledge Just In Case that knowledge may be required again sometime in the future. It is acknowledged today that it is important that students have a base knowledge across a wide range of areas but no longer is knowing the endpoint for the learning process within schools. In order to be a lifelong learner it is essential to shift the endpoint of learning for knowing to learning for understanding. If a student understands a concept then they can think laterally, apply the concept to different situations and they can be innovative coming up and unique ideas and applications. These capabilities are simply not possible if the student just "knows" about the topic. This is one of the principles which underpins effective thinking.

Teaching Approach: In the first education paradigm the teaching approach was primarily "the sage on the stage". Being the sage on the stage is not such a bad thing and this delivery method can be a very efficient methodology for getting across information and instruction. However we also known from our developing understanding of learning theory, that working alongside the students and having students engaging in peer to peer discussions and activities is a very effective methodology for bedding down understanding of knowledge and concepts and allows the child to experiment with new ideas and concepts. Once again it is a matter of balance for each teacher to negotiate, taking into account the teachers particular personality traits alongside the needs of the learners that they are engaging with.

Learning Tools: The primary learning tools in the first education paradigm were paper-based books. With the advent of the development of the printing press (which ushered in the first modern education paradigm), far more people were able to gain access to written materials and this opened up a whole new world for those at that had the capability to read the material and subsequently write about their experiences. In the second education paradigm information is increasingly multimedia in format and the learning tools which students engage with will become increasingly electronic and multimedia orientated. Paper will always have its place as it is a very effective technology and we are by no means heralding its complete demise.

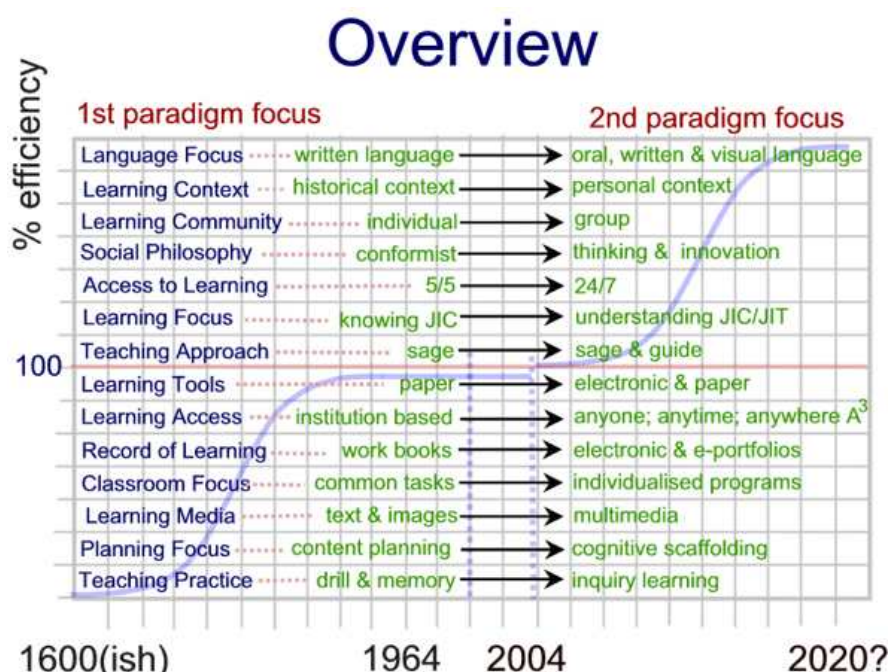
Learning Access: Access to formal learning environments was almost always based around an institution in the first education paradigm. In the second education paradigm Anyone can gain access to learning at almost Anytime and from Anywhere (A³) either formerly or informally. This A³ approach to learning is shaking the very foundation of what school has always been in the minds of many people. There is much discussion as to the need for schools in the new paradigm and what their role will be and while their role is changing significantly the purpose for school remains the same.

“The purpose of education is to provide each member of society the capability to contribute to the collective goals, (philosophical, idiosyncratic, practical and social), of that society where these goals are based around the accepted values of the community and that those goals and values are based on the historical and cultural wisdom of that community”.

We do not see this changing greatly but how schools fulfil this purpose will be very different.

We are social beings and enjoy each other's company and whether it is our workplace, our play place or our social place we enjoy to congregate together, exchange ideas and interact socially and school is a perfect place to learn the rules of social engagement and how to successfully work with one another.

Record of Learning: Workbooks have been common record of learning tool for students throughout the first education paradigm. In the second education paradigm there is increasing shift to recording information electronically and in particular we see a very bright future for the concepts that underpins electronic portfolios which are available in a web based environment. Some learning management systems such as the Knowledge NET are already experimenting by having students use reflective blogs, project management tools, goal setting tools and journalling software in order to record their learning journey, express their opinions and discuss their ideas.



Classroom Focus: The classroom focus was the provision of common working and the setting of common tasks for all students in any given class. The brightest, the average and the underachiever were all provided with predominantly the same level of work and while it was acknowledged that this was unfair and inappropriate it was virtually impossible to develop individualised courses of work for every student in the previous paradigm. The development of Digital Learning Objects and electronic assessment tools

are welding together the possibility, for the first time that teachers could deliver individualised instruction, when necessary, without spending most of their life clutching a photocopier! It is increasingly becoming possible to deliver interactive learning experiences that are more appropriate to the needs of each group of learners by making use of Digital Learning Objects and sequencing them in web based learning management environments.

Learning Media: The invention of the book brought together to different types of media, text and images, in a format that was portable, flexible and relatively speaking, affordable. The second education paradigm acknowledges the existence of a whole range of new media including animations, voice, video, interactive environments, and it also acknowledges the fact that students have different "profiles" when interacting with each of these different media formats. Some children respond to text extremely well whereas others can learn far more efficiently and effectively when interacting and working with video or animation. Students need to be aware of which media they best interacting with and in which circumstances each media is most appropriate for their learning needs. Knowing this provides them where far greater capability to be successful in their lifelong learning journey.

Planning Focus: When creating units of work for students, there is a tendency for "first paradigm teachers" to plan and sequence the work around the content which they are going to present rather than building an overarching conceptual framework. In other words planning units of work has historically meant sequencing content delivery. In the second education paradigm the endpoint focus of the learning is understanding and in order to build an overarching conceptual framework of understanding the teacher needs to scaffold a sequence of concepts which are underpinned by particular knowledge-bases/elements.

The transition from the desired end point being knowing to the desired end point being understanding is possible through appropriate conceptual scaffolding techniques as applied by teachers. In order to understand the concept students need to develop an overarching conceptual framework which is made up of numerous knowledge bases with each knowledge base contributing to the formation of an individual concept. The transition from knowing (the knowledge base) to understanding (the concept) is achieved through the use of clever, open ended, higher order (modified Bloom), fertile (Harpaz) questions making use of the rich multi media resources which are primarily available via the internet as per the second education paradigm.





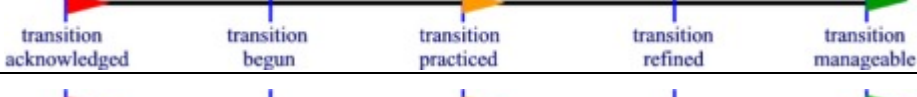






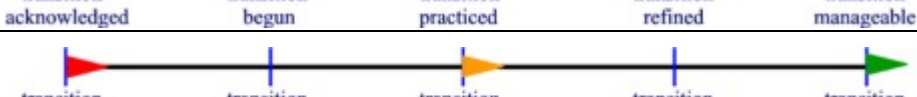

It is not that students have never understood in the past but rather it is that we are extending the possibility for far more students to understand in this new paradigm. The key then is to appropriately sequence the knowledge bases/elements and the activities that develop these knowledge bases into conceptual elements so that the maximum number of students can follow the progression. Inevitably each knowledge base will need a range of activities embedded with clever questions in order to meet the myriad of individual students learning styles and cognitive capabilities and engaging as many media as possible increases the chances of this happening. This is a very different way of planning and it will take some considerable professional development for teachers to develop skills in this new conceptual scaffolding process. More on this can be found at

[\[http://www.teachers.work.co.nz/archive_Sept_2004.htm#Scaffolding\]](http://www.teachers.work.co.nz/archive_Sept_2004.htm#Scaffolding)

Teaching/Assessment Practice: Drill and memory has been the core of most of the formal assessment process within the first education paradigm. It is not that we are no longer going to make use of drill and practice but once again we are shifting the endpoint of instruction from drill and practice through to an inquiry learning model. Inquiry learning encourages the building of understanding through almost all the various second paradigm transitions discussed above.

As an exercise it would be worthwhile to examine each of the continuums below and as a self management task highlight where you think you may be on each of the continuums. This will also highlight particular areas of professional development that you require on a personal level. It would be worthwhile exercise to then repeat the task and highlight where you think your school rates in each of the transitions. Once you have done both tasks it would be interesting for you to look at differences and similarities in how you rated yourself personally and how you placed the overall culture of the school.



transition	Place on continuum
Language Focus balanced use of visual, oral and written formats	
Learning Context concepts introduced using personal contexts	
Learning Community balanced use of individual progression and group work	
Social Philosophy thinking skills and innovative practices encouraged	
Access to Learning learning materials available to most students 24/7	
Learning Focus targeted endpoint for most students is understanding rather than knowledge	
Teaching Approach a balanced approach between sage and guide	
Learning Tools students have access to electronic and traditional media	
Learning Access students are able to access the most learning materials anywhere, anytime	
Record of Learning assessments recorded and made available electronically via e-portfolios	
Classroom Focus work presented is balanced between individual and group requirements	
Learning Media teaching and learning balanced between JIT and JIC requirements	
Planning Focus increasing transition to planning based around cognitive scaffolding	
Teaching Practice inquiry learning methodology increasingly used by students	

So how will these transitions be introduced into education when teachers are already frantically busy? 2007-2010 is a period of time that will be quite frightening for many educationalists. Not only will almost all schools have to implement a new curriculum but they will also have to train every staff member on how to use a completely new set of electronic tools in order for them to operate efficiently and effectively in this new paradigm. Three of those tools are:

Student Management Systems: In order to record assessment data, manage absences, record health and social details, provide timetabling support and management, provide tools for graphing and interpretation of the assessed data, demonstrate "coverage" of curriculum and as well as possibly including a library cataloguing and borrowing system. . . . Schools will require a comprehensive software package to manage all these issues.

Assessment software: A software based solution will form at least part of the process of effectively assessing student understanding of prescribed competencies. These programs are getting increasingly sophisticated and far more capable of making accurate assessments of not just explicit knowledge but also implicit applications of understanding.

Knowledge NET's ©: Schools began with simple in-house intranets available only to those people within the school environment and these then evolved to becoming intranets that were available from outside the classroom environment and now we have web based intranet environments which can publish web pages/sites very easily using WYSIWYG (What You See Is What You Get) editing tools that are embedded in the web browser. These then matured into web based environments which allowed groups of schools to work cooperatively together as an extranet. The final incarnation on this continuum is the Knowledge NET© [<http://www.knowledge-networks.co.nz>].

The Knowledge NET© is a resource rich personal intranet for every student and every staff member as well as an integrated Internet web site fed content directly from material placed online by the users. The Knowledge NET© also hosts the extranet which allows clusters of schools to share subjects and resources in a remote learning management environment. This is particularly effective in supporting the teaching and learning programs now being delivered by video conference. The Knowledge NET© also has embedded within it its own education search engine and library, access to Digital Learning Objects and easy access to common tools (dictionary, thesaurus, maps, quotations), as well as access to encyclopaedias and newspapers so that students have a complete research centre when using any internet enabled computer (access by userID and password).

Digital learning Objects

As well as the software tools described above there are other resources that are quietly being built around the world that will allow teachers to make use of digital content built specifically for use in Knowledge NET©'s/intranets. These web based resources are known as Digital Learning Objects. Increasingly Digital Learning Objects are being created in a web format and stored on databases that are being made available to schools throughout the world. At the extreme end of this continuum are the DLO's being created by the Massachusetts Institute of Technology; entire courses! The Massachusetts Institute of Technology was one of the first of the major institutions to provide completely free online courses. MIT has available on a web site [<http://ocw.mit.edu/index.html>] hundreds of online courses that are free to access for anyone, anywhere, anytime. There are 600 courses available online and there are more to come. The potential this offers "students" around the world is enormous. In the United Kingdom the Open Knowledge Initiative; a collaboration

amongst the leading universities, is putting online an "open source extensible architecture" that specifies how components and educational software environments communicate with each other. Other "object repository management systems" are being offered such as Fedora [<http://www.fedora.info>] which can be used to create interoperable web based digital libraries, institutional repositories and information management systems.

At the other end of the DLO continuum is a picture library [Free Foto <http://www.freefoto.com>] or a collection of science questions [NZCER Resource banks <http://arb.nzcer.org.nz/nzcer3/nzcer.htm>] or a unit of work on Shakespeare's genre [Fathom <http://www.fathom.com/course/21701729/index.html>] or a collection of ICT training modules [Kidzonline <http://www.kidzonline.com/TechTraining/>] . . . the number of DLO's available is enormous, already there are millions.

The idea of Digital Learning Objects is that you combine them together in a sequence to create a unit of work or lesson plan. The introduction to a unit of work may come from one DLO library, the animations from another, the questions from another, the background reading from yet another and the extension activities from another location again. This is where the WYSIWYG (What You See Is What You Get) based Knowledge NET[©] comes into its own as it allows educators to "drag and drop" or "cut and paste" DLO objects from their original online location into this environments, edit them if necessary (if allowed under the "conditions of use") and then publish them on the internet for students to access. The beauty of this is that the teacher requires no knowledge of HTML coding whatsoever and requires only a similar level of skill required to use a standard word processor.

Students can also place their work online using the same approach. **These totally web based environments are beginning to replace traditional "office software" as the standard software/service for publishing.** Compiling rich multimedia content is now a very straightforward process allowing teachers to spend more time on the process of the conceptual scaffolding that underpins the unit of work.

Each collection of DLO's comes with its own "rights of use" which describes how educators may use these objects. Some collections allow teachers to use the objects within that collection in any way they wish, editing them and manipulating them as they desire. Other collections have specific copyright conditions associated with their use. Most DLO repositories have the "conditions of use" link at the bottom of their web page. Copyright is a major issue and with the advent of WYSIWYG editors and the Knowledge NET[©] automatically inserts a metadata table for users to complete with every page that is created. Teachers or students then simply insert the relevant information into the table and this acknowledges the origins of the content that has been used electronically.

It would be reasonable to assume that the prolific supply of online units of work, DLO's (Digital Learning Objects) and online resources in general will initiate the metamorphosis of the teachers focus from information/unit creation to the development of clever questioning strategies which encourages students to interrogate the supplied resources in such a way that they are better able to build conceptual frameworks of understanding. The subsequent learning experiences will hopefully lead to a deeper understanding of the knowledge, as well as ensuring its retention.

Some of the most interesting work in creating learning objects is happening at the K-12 level. The initiative by the Australian and New Zealand governments under the auspices of the Learning Federation [<http://www.thelearningfederation.edu.au>] is backed by a \$60 million budget to develop online interactive curriculum content specifically for Australian and New Zealand schools. To quote the web site the aim here is to ensure that "The systems will also facilitate the breakdown of content into discrete 'objects' and the reassembly and repurposing of these to suit the particular needs of teachers and students."

The concept of learning objects involves the creation of discrete items that are described by metadata (an image of a fire engine would include the metadata; creation date, author's name, keywords, curriculum areas that this might be associated with as well as rights associated with this Digital Learning Object). There is obviously quite a range of descriptors that can be applied to each learning object, and so several standards have been developed, the one most institutions seem to be using being referred to as "Dublin Core" [<http://www.dublincore.org/>]. This project and many more like it around the world are building up huge repositories of web based learning objects that will be made available to teachers to create extensible learning opportunities.

As we have mentioned previously, the 21st century will be dominated by those who have an understanding, as well as knowledge of ideas and concepts. Having focused on "knowing" as the endpoint for learning for so long, considerable perseverance will be required to make the transition to teaching for **understanding**.

The Necessity for Lifelong Learning: The approach described above cannot be successfully established without the students learning similar teaching and learning techniques to those that their teachers are employing. There are several reasons for this line of thinking:

1. If students acquire the capability for asking clever and well constructed questions then they will be able to interrogate information creatively and build understanding on their own when and where the process is required; this is truly "lifelong learning". These skills will flow through into their work and social lives, resulting in them and their work associates, friends and family acquiring a far better understanding of changes within all spheres of their world whether it be their work place, politics, new technologies, building relationships . . .
2. In order to construct meaning, students need to think about their own thinking in an extrinsic manner, (metacognition), using a form of self-directed questioning that will interrogate their own understanding. By encouraging this we can help them to better understand, refine and present concepts as well as "create" new understandings.
3. Effective questioning strategies need to be strategically thought through so they build on present knowledge and understanding and allow the extension of present understanding. What this means is that asking questions that assume some already developed conceptual understanding, may well limit the possible learning response if that presumed preliminary conceptual understanding is not established and processed sufficiently to be applied in a (possibly) different context. The challenge to teachers then is to begin to build **concept scaffolding plans** that facilitate the "incremental development of increasingly sophisticated conceptual frameworks". [http://www.teachers.work.co.nz/archive_Sept_2004.htm#Scaffolding]. The use of Digital Learning Object's allows teachers to focus more on scaffolding the conceptual framework and require less time on developing content.

The three software tools (Student Management Systems, Assessment software and Knowledge NET's ©) will need to be interoperable and data stored on any one of these systems needs to be available to any other program/system and this will require some degree of centralised direction/management. If you couple the professional development that is required to effectively use these three software tools with the need for professional development that will be required for teachers to adopt not just a new curriculum but a whole new raft of teaching strategies and sit that alongside the 21st century understanding of how students learn most effectively, you begin to realise the scale of professional development that is going to be required of all teachers.

It is important for teachers to have an overarching philosophical framework for teaching and learning as described above that is in keeping with the shift to the second education paradigm before we start the micro-upskilling of teachers in the transitions outlined in the

diagram above (there are many other transitions not included in [diagram 3](#) (Page 15). There has been a tendency in the past to develop teacher capability in a variety of the micro-pedagogical areas without an overarching philosophical framework and because of this approach it becomes almost inevitable that we end up with teachers receiving philosophically quite contradictory (at worst) and incompatible (at best), teaching and learning instruction during the process of their upskilling.

There has been a recent global trend towards schools and individual teachers managing their own professional development program and while this sounds attractive, teachers may/do tend to choose professional development in areas they are already competent in rather than those areas that require further development.

*At this point I would like to insert a key point in regards the professional development of teachers: Teachers require upskilling in effective teaching **and** learning strategies but as a general rule professional development has been historically focused on assisting schools in delivering and assessing the delivery of the schools “program”. The second education paradigm has at its end point a focus on understanding rather than knowing, hence the focus of any professional development should be on improving our understanding of:*

1. Learning: How do students learn, what is their cognitive capacity for learning and where are they in their learning cognitive development continuum, and which strategies best meet the capability of any given student at any given point in their learning continuum?

We now know a lot more about the mind and how it manages new ideas, holds on to memories and builds conceptual frameworks, than we did previously (mostly through the fMRI scanning technology) (<http://www.cogneurosociety.org/content/links>). We have a huge distance to go before can say we understand what is happening in our minds and how we can best maximize that potential but we do know a lot more than we did in the 20th century. But much of what is taught to teacher graduates and also in professional development sessions for teachers in the 21st century is still based on a 20th century knowledge base.

2. Teaching: Which teaching strategies maximize what the individual student or cadre of students is capable of understanding and what information is required to be known in order for the strategies to be selected and put into practice? The key elements here are that:

1. Teachers need to be aware of the wide range of teaching strategies that are available to them.
2. Students have available to them rich information and communication resources.
3. Teachers are aware of effective assessment (not testing) strategies and have them in place, which then informs them quite clearly about what the student understands and what point(s) in the learning process/continuum are in need of remediation.

Too often "teaching and learning" has come to mean a singular entity rather than two distinctly different but interlocking fields. Teaching staff need considerable upskilling in both of these two areas – also, the two areas, although interrelated, need to have a degree of separation so that an appropriate balance of both is delivered through professional development processes.

The required professional development needs to focus on generic **teaching and learning practices** that require considerable upskilling - not the teachers' knowledge and understanding of new content. In order to achieve this traditional professional development course attendance will simply not be economically viable or practical for all staff over such a

wide number of upskilling areas or so a new model is required. One such possible model is described below and the purpose for its presentation is to stimulate discussion on innovative solutions to the dilemma outlined above rather than present it as "the solution".

To manage professional development on this scale it is suggested that each school or group of schools providing student population of 800 or more could be offered a two-year professional development staff secondment whose role it would be to develop teaching and learning capabilities amongst the staff of the school(s). Their title could be "Professional Development Coordinator". This person would not need to have an understanding of each curriculum area but rather their strength would be in teaching and learning practices as this is the focus of the required professional development.

The "Professional Development Coordinator" would require two months of intensive professional development themselves prior to taking up this role and would also require ongoing professional development for one day in five for the period of their two-year secondment. Following this two-year period a new appointment would take on this role, expanding the knowledge base within each school or group of schools.

The "Professional Development Coordinator" would also sit in on classes and provide suggestions and insights into how an individual staff member can improve their teaching practices as well as providing professional development sessions on effective teaching and learning in a one-to-many environment. The qualities of the "Professional Development Coordinator" would be considerable but above all this person needs to be passionate about teaching and learning and be someone that the teaching fraternity will trust implicitly in a supportive peer-to-peer capacity.

This one-to-one and one-to-many professional development process program would be augmented with online national professional development opportunities. This would take the form of electronic professional development and would make use of the WYSIWYG interfaces and rich digital learning objects in order to ensure that the quality of instruction was at the highest level. This would also assist in modeling the teaching and learning that would be expected of the teachers themselves. As mentioned earlier software packages such as Macromedia's product "Breeze" has huge application possibilities due to its capability for streaming simple video as well as presenting interactive multi-user workspaces and providing inbuilt "chat" communication tools. Videoconferencing also has a role to play in this mix although for many schools the expense of this technology means it will be an unaffordable option.

This integrated online and face-to-face professional development program is an expensive option; but as most Departments/Ministries of Education are pursuing this innovative infrastructure development described earlier, it would all be rendered pointless without investing significantly in the professional development of those charged with its implementation. It would be like crafting the menu, buying the food, setting the table, hiring the chef and waiters, sending out invitations but then not providing an address of where the dinner was to be held. .

Chapter 4: The Main Course

The main course consists of a review of the “what schools deliver” in order to meet the purpose of the dinner. This course needs to be satisfying as well as being palatable and inspiring. That there needs to be a cohesive and well thought out central curriculum is without doubt but unfortunately there is a tendency for teachers to focus on the content of such documents rather than the conceptual ideals that underpin the document. As a teaching fraternity we need to face up to a major obstacle here: to quote Jacqueline Grennon Brooks in a recent article entitled "To See Beyond the Lesson" ²

"Teaching is a complicated process and it is imperative that we stop trying to make it appear simple. Many teachers readily acknowledge that for a variety of reasons they engaged in little meaning making with their students. Many acknowledge that they engage in little learning for meaning when they were students. Consequently, few teachers have actually had the experience as students of discerning patterns among ideas, generating unifying principles, or identifying similarities and differences among events. Few teachers are able to imagine how such classrooms could operate. "This is really great," they say, "and I'd love to teach this way, but we have to cover the curriculum."

Historically the focus of most curriculum documents has been the content they contain. In teaching parlance it is not "location, location, location!" but rather it is the "content, content, content" that really matters and the primary reason for this is that this was how teachers were taught themselves. In social service programs a lot of effort goes on to "breaking the cycle of violence". The understanding here is that the very people who are the victims of violence have a tendency to become people who victimise others violently. The same applies to teaching. We tend to teach in the manner in which we were taught, even though we know that our learning experiences were possibly very poor ones. This is a hard cycle to break.

This change in teacher culture is something we urgently need to get our heads around, otherwise any new curriculum that is instigated and which does not contain very clear ambitions (in order to meet the needs of the 21st Century learner by definition the curriculum will not focus on delivering content), will have the previous curriculum content simply assumed and inserted where teachers think appropriate.

The other stakeholders who must be taken along on this journey are the parents/caregivers. Many schools which have moved into areas such as the teaching of thinking, the development of learning attitudes, and lifelong thinking skills have been criticised by some parents/caregivers as having no regard for "standards" and there have been a multitude of Chicken Little's, racing around proclaiming that the sky is falling (standards are falling) because Johnny does not know the capital of Venezuela and Mary cannot divide two fractions as a piece of mental arithmetic. This parental viewpoint is totally understandable when you consider that they only have their own education experiences to go by.

² Jacqueline Grennon Brooks "To See Beyond the Lesson" Another rather long URL from ASCD http://www.ascd.org/portal/site/ascd/template.MAXIMIZE/menuitem.459dee008f99653fb85516f762108a0c/?javax.portlet.tpst=d5b9c0fa1a493266805516f762108a0c_ws_MX&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journaltypeheaderimage=%2FASCD%2Fimages%2Fmultifiles%2Fpublications%2Felmast.gif&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_viewID=article_view&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journalmoid=c570bf8f07eaff00VgnVCM1000003d01a8c0RCRD&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_articlemoid=cb90bf8f07eaff00VgnVCM1000003d01a8c0RCRD&javax.portlet.prp_d5b9c0fa1a493266805516f762108a0c_journalTypePersonalization=ASCD_EL&javax.portlet.begCacheTok=token&javax.portlet.endCacheTok=token

Although many parents/caregivers readily admit that their education experiences were woefully inadequate they have not been exposed to any other education models. For this reason it is imperative that any change in education on this scale must be accompanied by informed debate, with the community provided with clear and well presented background information across a wide range of media formats. Standards are important but they must be standards that are keys for 21st Century success not historical standards that are no longer relevant.

An important note should be made here that this is not a reductionist policy where the only things that are taught are things that have life-skill applications. There is joy in coming to a point where the learner understands a new concept, an idea or philosophy and they experience the "a-haaa" moment and even if that concept, idea or philosophy has no practical application whatsoever, it can be validated through the fact that the process and underlying euphoria of discovering and understanding a new concept has been experienced. The motivation for pure research is not just the glory and/or financial benefits but rather it is the "a-haaa" moment which is a very pleasurable one. So as usual it is all about balance in the delivery of and deciding what competencies students require to be effective 21st century citizens.

Supporting this is the realisation that it is simply not possible or desirable to deliver the historical syllabus that so many parents/caregivers expect of their local school. This is not possible or desirable for three fundamental reasons:

1. Given that our end point has now migrated from knowledge to understanding and that teachers will need to set clever, higher order, open, rich, fertile questions along with the questioning strategies that assist in the development of fundamental knowledge, the idea of doing "space" in three weeks as a science unit simply evaporates. If the 21st century teacher sets thematic topics for students such as space, dinosaurs, weather, travel, heroes, volcanoes, mathematicians from history, village life, earthquakes, the undersea world . . . There is a greater than ever chance that the student will simply pay \$2.99 and download the necessary project from School Sux [www.schoolsux.com] or some similar easily accessed database of online school projects.

2. In order to teach a unit of work with the opening question

"compare and contrast the development of life on earth with that on Mars by identifying three similarities and three differences between the features of the planets. Using one of these differences use it to develop a hypothesis as to why you think life on earth has developed so prolifically while life on Mars seems nonexistent".

The teacher needs to provide rich resources in order that the student can carry out significant investigation and research and cannot simply download or copy and paste the answer or project from a single web based source. The upshot of this is that the amount of work perceived to have been "covered" will be significantly less than that apparently learnt through doing a study on "the solar system ". Asking clever, rich, fertile or open questions means a much more focused approach to content and there will be a perception that schools are delivering less. Rather than surface knowledge being taught there will be a greater emphasis on more depth and a focus on understanding rather than teaching knowledge for knowledge sake.

3. There are increasing demands on schools to deliver a wide range of new skill sets (such as information and communication technology skills, a wider range of literacy capability, project/time management, "keeping ourselves safe", . . .), an increasing amount of time carrying out what can be best described as "social service" work (working more closely with the parent/caregiver, ensuring appropriate care at home, sporting/cultural commitments), additional time teaching "critical thinking skills", more thorough assessment of students. . . . If this is all to be taught and encouraged then there is simply not the time left in the day to deliver the historical curriculum content.

How is it even remotely possible to deliver all of these new expectations, teach more creatively using a broad range of questioning strategies and rich resources, and still deliver the same amount of baseline content? It is simply impossible!

But we must communicate these changes to the communities that we service and not just assume they are aware of these things through some form of osmotic process. Marketing to our communities the changes embedded in the emerging new paradigm of what “school” is, is absolutely critical, otherwise the teaching fraternity may risk a barrage of criticism from thousands of “Chicken Little’s”.

Given the purpose of education outlined earlier what sort of curriculum would meet this purpose and the needs of 21st century learners? The 1998 DeSeCo report released by the OECD (and unfortunately no longer available online) investigated 12 countries and their education systems in an attempt to identify and possibly define essential or core competencies that were generic for all citizens. This report initiated a series of follow-on reports by various agencies, in particular the research work of the Programme for International Student Assessment PISA study entitled “Learning for Tomorrow’s World” [http://www.pisa.oecd.org/document/55/0,2340,en_32252351_32236173_33917303_1_1_1_1,00.html] with as well as Information Network on Education in Europe (Eurydice) paper entitled “Key Competencies: A Developing Concept in General Compulsory Education” [<http://www.eurydice.org/Documents/survey5/en/FrameSet.htm>] (the introduction of this report pp11-25 is particularly valuable). These reports then lead to a draft set of defined competencies that **could** more suitably underpin at least part of the purpose of education. Returning to the metaphor of the dinner party, it is important to remember that a dinner party is not just about gaining sustenance, but alongside this it is a social occasion and one which would hopefully encourage greater understanding via a wide range of discourse and debate. Through the modelling of social interactions and teaching skills we can encourage acceptable social behaviours and responsibilities common to responsible citizens and build effective communities.

Two antipodean sets of competencies that are in the discussion phase have been released by Australian and New Zealand governments for discussion. The Victorian Department of Education (Vocational Education & Training) highlights seven generic competencies [<http://www.sofweb.vic.edu.au/voced/ented/keycomp/what.htm>] that people would require for effective participation in the workforce and they have listed these as:

- **Using Information:** the capacity to locate information, sift and sort information in order to select what is required and present it in a useful way, and evaluate both information itself and the methods used to obtain it.
- **Communicating Ideas:** the capacity to communicate effectively with others using a range of spoken, written, graphic and of other non-verbal means of expression.

- **Planning & Organising:** the capacity to plan and organise one's own work activities, including making good use of time and resources, sorting ideas and priorities and monitoring one's own performance.
- **Working in Teams:** the capacity to interact effectively with other people both on a one to one basis and in groups, including understanding and responding to the needs of clients and working effectively as a member of the team to achieve a shared goal.
- **Using Mathematics:** the capacity to use mathematical ideas, such as number and space, and techniques, such as estimation and approximation, for practical purposes.
- **Solving Problems:** the capacity to apply problem solving strategies in purposeful ways, both in situations where the problem and the design solution are clearly evident and in situations requiring critical thinking and a creative approach to achieve an outcome.
- **Using Technology:** the capacity to apply technology, combining the physical and sensory skills needed to operate equipment with the understanding of scientific and technological principles needed to explore and adapt systems.

A proposed framework of essential competencies being investigated for the New Zealand compulsory education (year 0-13/k-12) sector by the Ministry of Education [<http://www.tki.org/r/nzcurriculum/docs/CompetenciesDiscussionPaper.doc>] includes the following five essential competencies groups coupled with three attitudinal competencies.

- **Thinking:** critically, creatively and logically
- **Relating to others**
- **Belonging, participating and contributing**
- **Managing self**
- **Making Meaning:** Multi-literacies and using language, movement, symbols and technologies

Attitudinal competencies:

- **Motivation:** including willingness and "can-do" attitude
- **Confidence:** including a view of the self as a competent learner
- **Curiosity or inquiry:** including open-mindedness

There will undoubtedly be a multitude of permutations drawn from a wide range of competencies presented and debated by governments over the next 10 years. What we can be assured of is that literacy and numeracy will still feature within any set of competencies, however our concept of literacy will have to expand considerably to include a wide number of literacies [http://www.i-learnt.com/Information_New_Literacies.html] in order to be a lifelong learner. Our concept of numeracy capability will also need considerable revision and reflection.

Many substantive issues flow directly from the advent of the second paradigm (these have been documented earlier in this article), and the above competencies will become interwoven with the changes in teaching and learning practices that flow from the advent of the second paradigm.

Are you ready for dessert now?

Chapter 5: Dessert

In order to deliver this rich information and communication environment it is necessary for every classroom to have access to infrastructure software, application software, curriculum based software as well as an effective hardware and cabling infrastructure.

Infrastructure Software & Standards: a brief list of the essential infrastructure software tools and standards that schools now require can be quite overwhelming.

- Nationally delivered (not necessarily free) high speed filtered internet service within an educational VPN environment which functions within Quality of Service (QoS) guarantees.
- Published standards for Infrastructure hardware (cabling/routers et all)
- Published Interoperability standards (such as the Schools Interoperability Framework)
- Student Management System (SMS) software (including truancy management)
- Assessment software
- Remotely hosted (ASP) internet/intranet/extranet/Knowledge NET©
- Library and resource software
- Web based browser: Mozilla, Firefox, Internet Explorer, Netscape . . .
- Access to Digital learning Objects (DLO's) via the intranet/Knowledge NET©

The necessity for schools to have access to high speed, filtered internet is now beyond doubt. High-speed Broadband Internet access must be both available and affordable for learning institutions, homes and mobile environments. Broadband/ High-speed access is defined as being greater than 0.5Mb/sec (guaranteed). To meet these requirements, high-speed coverage will be achieved via a combination of satellite, DSL, cable and wireless. Where necessary this will require the unbundling of monopolistic telecommunication providers via government intervention. To deliver this there are some infrastructural requirements such as:

1. Authentication should be managed by the centralised Ministry/Department of Education via an **LDAP** (or similar) **authentication server** which provides access to recognised services via a single password and username. Services that could be supplied in this manner include access to a school's Knowledge Net © management and assessment software, ministry/department of education information, libraries of Digital Learning Objects bought under licence for teacher access . . .
2. The **Quality of Service (QoS)** provided by all recognised suppliers must meet quality standards set by the ministry/department of education. These "quality of service standards" should be published and made publicly available so that any software developed meets the required standards for interoperability, speed, reliability and ease of use. It may be that auditing of this will be necessary.
3. Schools will all be part of a **Virtual Private Network (VPN)**, allowing filtered and controlled Internet access and a safe, secure (firewalled) environment where every user can be tracked, if and when necessary. The Virtual Private Network environment will allow for free exchange of information and material (including rich data transmission), from any point to any other point within that environment,. The Virtual Private Network will be governed by standards set by the Ministry/Department of Education.

What is more, these tools must function under interoperability standards so that data only needs to be entered once into one of these software platforms (usually this will be the Student Management System) and this software exports a "flat data file" to the web that allows the other packages to update their data sets from.

It is also important that the interface that teachers interact with for each of these packages is intuitive, web based and available 24/7. Authentication, providing levels of access to each of these tools, should be via a single userID and password or alternatively via biometric (fingerprint/Iris scanning, facial recognition . . .) analysis which will provide a portal gateway to all necessary resources and tools that the user requires.

In order to accomplish this it is necessary for the Ministry/Department of Education to initiate interoperability and authentication processes within their country/state/county.

On top of this it is necessary that each of the competing software products in each of the various areas described allow the dataset accompanying each learner to move with them through their lifelong learning process. At present almost every country suffers from a scenario where numerous pieces of data are collected regarding a students academic progress, competency capability, health, social welfare, sporting capability but very rarely is that data interrogated and made full use of. Often the transition from primary/elementary school through to junior high/college/high school sees almost no valuable data whatsoever accompanying the child to the new institution. The new institution starts the teaching and learning processes “flying blind” with almost no knowledge of the capability of the students that they are working with and they set about systematically re-collecting new data over several years in order to recreate the dataset to a point where it once again provides useful and reliable information on student capability.

With the technology we have available right now each student should have a complete dataset follow them through their compulsory education and then be given to that student to host on their own Knowledge NET © (known as a MicroNET) when they complete their compulsory sector. The MicroNET will host this student this dataset as well as their electronic portfolio. It will be then up to that student as to how that dataset is used from then on and which elements within the MicroNET of the information will be made public will be kept private.

Application Software: As well as infrastructure software there is also a pressing need for application software. Unfortunately much of the ICT (Information and Communication Technology) focus has been on atomistically teaching discrete elements of “office” software products rather than the overarching systemic architecture and teaching students to effectively query “help” menus and provide them with lifelong learning skills enabling them to adapt to continually iterating software applications. The role of office products such as Microsoft Office is reducing steadily and will continue to do so as open source products improve their capability and quality, but there is another threat to present dominance of “office software” in education.

The second element contributing to the reduction in the use of proprietary office software products is the capability for publishing to the Internet from WYSIWYG editing tools embedded in the Knowledge NET © and the MicroNET. With the application of XML capability within these WYSIWYG editing tools these tools will be able to carry out almost all the processes that publishing, spreadsheet, database and presentation tools are presently used for. It is expected that this XML capability within the Knowledge NET in the MicroNET to begin to become available within the next 12-18 months and to become well established in the next 3-4 years within these environments.

Computer Hardware: Infrastructure development has been discussed already but schools will also need to investigate how to conclude the “last mile” along with deciding which hardware tools (laptops, desktops, tablets, PDAs, digital whiteboards) will best deliver and allow the manipulation of these rich information and communication toolsets as well as the application software packages.

The computer/laptop: For some time now, some schools have been experimenting with the use of wireless networks and now with the establishment of 56 Mb per second wireless LANs using the 802.11g standard [http://www.teachers.work.co.nz/archive_June_2004.htm] we believe that the best combination for schools for "last mile" delivery is the use of category 6 (for new installations) to individual buildings and then wireless distribution within the building. The main reason for the wireless application is a pedagogical one. Having students "tied" to pieces of cable surrounding the periphery of the room or having cables suspended from ceilings to each individual desktop or laptop (the result of which is teachers swimming around in a room of electronic kelp!) results in many students facing away from the teacher and/or each other.

To remove cables completely from the classroom, we need not only a wireless LAN but also lightweight laptop computers that are low-powered and have a battery life of 4-5 hours. Centrino low-power chip based laptops [http://www.teachers.work.co.nz/archive_June_2004.htm] meet this specification and can be housed in a simple docking station so that once they are placed back in the docking station the batteries are automatically being charged.

The potential for tablet-based computing is considerable. However, at the moment this technology is too slow for many classroom applications. We believe that within the next 2-3 years this issue will be resolved and the tablet-based computing will become a realistic option. The potential advantages of the tablet are considerable and are based around the present frustration of having to input data via a keyboard. Tablet technology allows for data to be input in a variety of ways including handwritten script to text technology, voice to text technology, as well as the traditional text inputting via the keyboard. These technologies have come a long way in the past few years and we expect this improvement to continue.

The other major issue regarding laptop technology is whether or not every student requires one. As laptop technology has become cheaper and more reliable, as a tool they have become a more realistic option for some situations. However, for most situations we do not recommend that each student has their own laptop at school. There are a number of reasons for this recommendation.

- Even low-power Centrino based laptop computers are quite heavy for young (year 0-8) students to be carrying around with them all day. There is also an optimal ergonomic balance between screen size and practicality of use. Reducing the screen size reduces the practicality of using computer technology and as a result making the laptops smaller and lighter compromises this balance.
- Teachers are not technical experts and we do not wish to have their time consumed with managing the laptops that the students carry around with them. The focus must be on teaching and learning not on the technology and anything that gets in the way of this focus needs to be eliminated. Having 25 laptops in the classroom is simply asking for technical trouble!
- One of the emerging essential competencies is working together in groups, managing relationships and the identification of roles within groups. Individualising the learning process by having each student being required to have their own laptop computer moves learning away from this essential competency and as such this situation should be avoided.
- Securing laptops is always going to be an issue. It is far from unknown for students to be "held up" and their laptop stolen on their way home from school, and there is the issue of where do they securely store it during the day. Another associated issue for some schools is bench space. Laptops take up a reasonably large amount of desk space in the classroom and this can also be a limiting factor is every student as one.

Some school administrators have banned the use of laptops during play breaks to ensure that children get a break as they have a tendency to constantly be using the technology every moment of the day. This is an issue to watch if you do have a laptop programme in your school,

These considerations leave us with the opinion that requiring each individual student to have their own laptop technology is detrimental to the overall teaching and learning outcomes that the school should be focusing on. Schools could mount a reasonable argument for senior secondary/college students having their own portable laptop technology but for junior students the negatives seem to considerably outweigh the positives.

With one low-power Centrino chip based laptop computer for each 4-5 students in the classroom solution the laptop computers are completely wireless and can be used by groups of students effectively and efficiently within the classroom environment. There is still an issue of managing this technology and ensuring that teachers do not become the default classroom technician and this issue needs to be addressed.

As students move more and more towards the inquiry learning process and they store increasing amounts of their work online in their web based Knowledge NET[®] it is no longer necessary for each student to have their own individual laptops as all their information is stored on the web rather than on the hard drives of the machines that they use. Even the students web based bookmarks are stored in their Knowledge NET[®] ensuring that whatever computer they use, they will have access to all their personal resources and research tools. We have now reached the A³ point - where schoolwork, personal information and research tools are available to Anyone, Anywhere, Anytime.

With the price difference between laptop technology and desktop technology falling dramatically and the performance of laptop technology equating to that of the desktop we see little advantage in purchasing desktop technology at this point in time. The other associated issue is securing your laptop technology so that it cannot leave the room without you knowing about it! There are a range of security devices that can be purchased at a reasonable cost to mitigate the possibility of theft and if this can be combined with effective classroom systems for the use of laptops they can be a viable option in small numbers.

Display Technology: The pedagogy underpinning this technology decision area is formed around the premise that teachers are required to be the "sage on the stage" for a reasonable amount of time as this teaching style is very efficient in transmitting information and conceptual ideas/frameworks across the large number of students in a small amount of time. It needs to be used in balance with being "the guide on the side" but being the sage is not something teachers should be embarrassed about doing but it should not feature any more than 25-30% of total time in the classroom.

As information is increasingly found in electronic formats it becomes more and more necessary for the teacher to be able to integrate multi-media resources within their presentations of ideas and concepts. In order to achieve this, several technologies are worthy of discussion. The use of multimedia projectors has increased dramatically over the past few years to the point now where they are an essential piece of classroom equipment replacing the overhead projector as the tool of choice for teachers. Costs have reduced along with dramatic improvements in display technology and multimedia projectors are now an essential piece of classroom technology for both the teacher and students to use as presenters and for the teacher and for students to be able to view multimedia presentations within the classroom.

Plasma and LCD screens may have their place in small classrooms but cost factors and the sheer scalability of the size of multimedia presentations that are possible using a multimedia projector virtually eliminate these options for the foreseeable future.

Augmenting the use of multimedia projector technology has been the rise of "smart whiteboard" technology. Smart whiteboards are electronic whiteboard devices that allow the demonstrator/teacher (this demonstrator may also be the student), to operate software packages directly from the whiteboard, add anecdotal notes to the presentation, interact with other smart whiteboards in other schools anywhere in the world and store the modified presentation in an animated format either on the local hard drive or on the Knowledge NET©.

This technology is expensive but we expect prices to fall considerably as more competition comes into the market and sales volume increases significantly. It is not essential technology but it is very powerful technology that allows the presenter to fully interact with the software simply, using their finger as a mouse and this allows the user to annotate and develop the original information. Storing the resultant combination as a JPEG image, a video clip or an animated presentation means that the enhanced digital content can be stored and shared simply and easily on the school Knowledge NET ©.

Another technology that is entering the market place is the "portable interactive tablet", not to be confused with the tablet laptop technology. The interactive tablet is generally the size of the screen element of a laptop computer and uses Bluetooth © technology allowing either the teacher or the student to "write" on the plastic screen of the tablet and have whatever is written down appear on the screen/smart whiteboard via the multimedia projector. The drawback of this technology is that as you are using a plastic pen on a plastic screen you have to look at that the screen at the front of the room to see what you are writing and to make sure you are writing in the correct location. Most students seem to adapt to this reasonably easily while the teacher may take a bit longer!

The interactive tablet can be a very effective tool with younger students who may not be able to reach the height of the smart whiteboard. We have also found this to be a significant technology with secondary/college students who are less keen to be seen in front of the room providing answers, ideas and content whereas they are quite comfortable to add their thoughts via the interactive tablet while remaining in their seats. At present, the interactive tablet technology is about 20 percent of the price of the smart whiteboard technology. At one-third of the cost of tablet laptop technology they are not cheap but they do offer a wide range of applications.

Chapter 6: Cheese & Port

Assessment has been the focal point of much of the professional development carried out over last 25 years and we have learnt much from this. One of the unfortunate consequences of this focus on assessment is the "paper war" that has resulted. In order to make the assessment process manageable and more meaningful for both the teacher and the learner two fundamental adaptations need to be brought into the assessment repertoire:

1. The use of electronic assessment is starting to become a viable and pedagogically acceptable part of the assessment process.
2. Assessment needs to be a partnership between the students' metacognitive reflections, (via the e-portfolio within their Knowledge NET) in partnership with the teacher assessing submitted work from the students in all three language formats (oral, visual and written).

1. There are a variety of assessment tools available, some which are very rigorous and have the possibility of providing considerable and informative data about student understanding [www.asttle.org.nz as an example], while other assessment tools provide very limited feedback on what students understand. It is imperative that we mitigate the effects of and limit the amount of standardised testing as much as is possible.

As electronic assessment tools become more rigorous and provide data that is useful to both the teacher and the student, then an interesting opportunity unveils itself. If the assessment package demonstrates to the students that there is remediation work required in a particular area, then in combination with the knowledge NET© the assessment package could point the student to a series of remediation activities. The remediation activities could be built "on-the-fly" from the library of Digital Learning Objects (DLO's) embedded in the Knowledge NET© to meet the individual needs of that particular learner as indicated by the assessment package. This process is in its infancy but there are pilot projects being proposed that could considerably reduce the assessment "paper war" that teachers are presently engaged in. It is important to note here that this requires very sophisticated software, making use of artificial intelligence in order to ensure that the Learning Objects produced, based on the assessment process focus on the required teaching and learning processes in order for the students to build and develop the key competencies that are required.

One of the other challenges that we have as teachers in this new environment is to develop a cognitive processing taxonomy that is simple to apply and takes into account an environment where we can now teach for understanding and do so much more effectively. A taxonomy developed in the 1970s and 80s by two Australian academics: John Biggs and Kevin Collis which "*categorises mental activity by quantity and quality attributes of the activities required by students or by the observable products of student work*" (assessment tools for teaching and learning technical report #43; August 2004) may provide just such a taxonomy.

The focus of this assessment schema was on the Structure of Observed Learning Outcomes (SOLO). The AsTTle (**A**ssessment **T**ools for **T**eaching and **l**earning) assessment and reporting team in New Zealand has used the SOLO cognitive processing taxonomy in order to ensure effective coverage of both surface knowledge and deep, relational/understanding.

Interestingly the AsTTle team discovered in their research that

"the majority of year 11 students defined studying or learning with surface strategies or methods (i.e., revision, re-reading, and reviewing of the year's work) and strongly agreed that learning involved building up knowledge by getting facts and information. In contrast, teachers preferred a deep view of learning, usually focused on academic, cognitive development, while at the same time, emphasising surface methods of teaching in order to prepare students for high-stakes qualification examinations or assessments (Brown: Teachers Conceptions of Assessment." [Unpublished doctoral dissertation, University of Auckland, Auckland, New Zealand].

In other words how teachers thought they taught and the way in which they desired to teach was at odds with how they actually taught and this appeared to be due to the fact that they would sacrifice their deeply held philosophical views on education in order to be seen as being successful in getting students successfully through "high-stakes" qualification examinations or assessments.

The SOLO cognitive processing taxonomy is very effective in its simplicity and we would suggest strongly that in order to provide a framework for delivering an assessment schema that this replaces the Blooms or modified Blooms taxonomy currently used by many teachers. There are some issues with the Blooms taxonomy, which we will not address at this point in time, but the SOLO cognitive processing taxonomy seems to address these issues as well as simplifying our understanding of teaching for learning. As mentioned earlier surface teaching addresses knowledge whereas deep teaching addresses relationships and interconnectedness (understanding).

As an example of the SOLO taxonomy consider the following line of questioning:

1. Teachers can teach/assess a knowledge element that can be described as uni-structural; where one particular knowledge element is discussed (taught) at a superficial (surface) level. An example of this may be:

"The sun is approximately 150 million km distant from the earth. Approximately how far distant from the earth is the sun?"

2. A question that is knowledge-based can also be multi-structural, having more than one knowledge element within its composition but still taught at a superficial (surface) level such as:

"The result of the earth being 150 million km distant from the sun is that the amount of heat that this provides the earth allows water to exist in three different physical states and that the dominant state that water is found in on earth is liquid. How many different states is water found on the earth and which is the most dominant of these?"

Questions that we would characterise as deep can be based around single; 1-1 relationships (relational) or multiple relationships; 1-many (extended abstract).

3. An example of a question that develops relational understanding around a single idea may be:

"One benefit to human beings of the earth being 150 million km distant from the sun is that water exists primarily in its liquid form, which is essential for life as we know it. If the sun was 200million km distant from the sun and water did not exist in liquid form on earth, hypothetically what would be one adaptation or innovation be that humans would have to make to continue to live on earth?"

4. An example of the multi-relationship (1-many) extended abstract question containing many ideas may be:

"Design a life form, complete with basic life systems, which could exist on a planet where water did not exist in its liquid form."

We can summarise the SOLO taxonomy in the table below:

	Surface Question	Deep Question
One Idea	Uni-structural	Relational
Many Ideas	Multi-structural	Extended abstract

There are significant benefits to this simple but extensible cognitive processing taxonomy. The AsTTle team has used this in combination with some very clever software to develop a powerful assessment tool that can guide both teachers in their teaching practice and learners in their learning processes.

One area that is providing considerable insight into student understanding is the use of electronic portfolios. For some time now portfolios have featured as a collation of samples of student work, often with no set format or purpose. This random sample of work tells us nothing about student progress and little about student knowledge and almost nothing about what they understand or are capable of describing.

One of the most significant and empowering assessment tools is student insight into their own learning. The capability of students to metacognitively reflect on their own learning processes is generally not something that occurs spontaneously, but rather something that students have to be awakened to, taught skills in and then it needs to be accompanied with a thinking culture that is pervasive throughout the entire school. This includes a complete new set of terminology and questioning strategies that students can use to analyse, monitor and describe their own learning.

Students need more than a single thinking tool in order to carry out metacognitive analysis of their own thinking (see chapter 2), they need to understand their own thinking processes, their own particular preferences when it comes to learning styles and have the language set which allows them to describe what is happening in their own minds based on modern cognitive understandings.

[http://www.brookes.ac.uk/schools/education/rescon/ocnef/CWSE_26_1_02lores.pdf]

Electronic portfolios have the capability to reflect this metacognitive process back to their teachers, their peers and their parents/caregivers. The ability to use e-portfolios within the Knowledge NET © [<http://www.knowledge-networks.co.nz>] to capture this reflected process provides invaluable information to not only the learner but also to the teacher who is assisting the learner in their learning journey (see chapter 3). A well crafted electronic portfolio will contain a set of tools that encourages the student to reflect precisely and concisely on their learning, using the language they have been taught. This allows them to learn from their own reflections and insights and fine tune their own learning processes in conjunction with teacher input. This process will be referenced against, (through a conferencing process with the teacher), the teachers' experience in interpreting student reflections and together these two insights provide an overall insight into how to improve the learning strategies and effectively remove any impediments to successful understanding.

The above statement is at best “noble” and of good intent but it is only possible with “buy-in” from the students. This requires a considerable degree of engagement as discussed in the introduction to this paper and we once again return to John Hattie’s quote about the teachers’ passion and capability being the main key to making a difference in the child’s learning. The capability of teachers to engage students in lifelong learning processes is absolutely critical and needs to be addressed urgently before we start sending ambulances down to the bottom of the cliff. Once we start spending enormous amounts of teaching time resuscitating disengaged students there will be no teacher time left to develop solutions that can inoculate students against the disengagement virus. This is certainly a good example of the old adage that “a stitch in time saves nine”

Historically teachers have dominated the assessment process but in this new model it is a partnership between the teacher and the student as the student increasingly takes ownership of their own learning. This is an essential aspect of becoming a lifelong learner.

Chapter 7: The Guest List:

Involvement of the entire learning community is critical for any successful institutionalised social process. In the past education was perceived as being the domain of the educated with the remainder of the community unable to listen to the conversation let alone eat at the same table. Even as we extend the concept of school to become a 24/7 process and where large amounts of the resource is available electronically, schools remain one of the last vestiges of community for many first world countries. They bring a diverse range of people together under the one united purpose.

For this reason it is critical to involve the extended community in the learning process. Software such as the Knowledge NET© contains a range of tools that allow even the most "busy" of communities to have direct and effective communication with their local school.

There are other less obvious advantages of involving the community in the schooling/learning process. We have already identified the fact that any successful society requires a large percentage of the community to be involved in lifelong learning processes in order to:

- Be critically literate in order to make societal based decisions that will improve the social wellbeing of all strata of that society.
- Make informed decisions at an individual level in a knowledge based society.
- Develop or adapt new products and services to fuel a growing economy.
- Ensure that the community is aware of the educational changes at hand and are less fearful of the sky falling on them as these changes progress.

The "experts" in the lifelong learning process are, or should be teachers and for this reason we expect that they will become an increasingly valued resource within their communities. Lifelong learning requires each community member to appreciate the teaching and learning processes, have an awareness of their own learning capabilities as well as the capability to use online information and communication tools which allow lifelong learning to become a practical reality in their lives. This in itself is a teaching and learning process and schools can become "lifelong learning hubs" for their communities, providing training in the area of lifelong learning and this presents an opportunity for schools to take on a much higher profile in their communities. This can be particularly true of smaller communities.

As schooling becomes increasingly autonomous and local content becomes an increasingly important feature, it is imperative that communities have some input into what this local content could and should become. The teaching community within a school will always have a degree of autonomy over what is taught within their institution as they are the teaching and learning experts but there is a degree of communication required with the community in order that school reflects their community within their teaching program.

Chapter 8: An After Dinner Mint:

So there you have it!

What happens next depends on you, the teacher - not “people in powerful positions”. You can change the way you teach and learn tomorrow; you can open up possibilities that have never existed before for your students or you can choose to do nothing.

What you do next does matter and you can make a difference. Having a sense of purpose in life is critical; it gives our lives meaning and makes the best possible use of gifts, talents and the passion we have been given. Fulfilling our purpose is a wonderful experience and the vocation of teaching is the most admirable of all as it allows the full expression of our talents and gifts and invests them in lives that will hopefully go on and make further differences that improve the lives of others we will never meet.

As teachers, we plant seeds and often we never get to see what blossoms but we, as teachers, remember our teachers and for good reason; they changed our lives and you will do likewise for those in your care; just how much difference you make depends on how you see their futures. Yes teaching is a challenging vocation and profession, that is why our best and brightest; our most passionate, should teach.

So what is the difference between effective teachers and schools and those teachers and schools which are not effective?

- Well, it is not how wealthy the parents are as there are too many excellent teachers and successful schools in very poor areas.
- It is not how many computers are in the school as schools with almost no technology have delivered exceptional teaching and learning environments for centuries.
- It can't be the constraining curriculum, as brilliant minds have emerged from the darkest of corridors where curriculums dictated the most linear of teaching strategies.
- If effective assessment schemes were the solution how did our brightest and most clever ever produce such gifted art, music, philosophical, mathematical, and scientific works, so many centuries ago?

Successful teaching and learning is really a simple formula that is assisted by the developments and ideas contained in this paper but none of these on their own, or all together, will create effective teaching and learning experiences for students. Quite simply, good teaching and learning environments are inspired by intensely passionate and articulate teachers who are consumed by the vocation of teaching. The technologies and ideas espoused in this paper will make these teachers even more efficient and empower them to reach more students more effectively but they cannot and will not make an uninspiring teacher into a brilliant or even a good teacher.

There are numerous movies about teachers who made a significant impact on the lives of their students and they mirror the real life teachers in real classrooms, every day and these teachers all share common elements; they are passionate and they are excited, they are honest but have an intensely optimistic outlook on life, they present a vision of what is possible; they can sometimes be a bit unusual and they expose and confront their students to the realities of life through highly contextual learning experiences.

And what motivates people to be so passionate about teaching? Usually it is the teachers that taught them! Encourage your best and most passionate students to be teachers; yes it is a challenging vocation but there is nothing on this planet more rewarding than seeing a student take up the mantle of teaching in order to make a difference in the lives of their students as yours did for you, and as you did for them.