

Occasional Papers

2002

Towards a model of best practice for integrating ICT across the curriculum

By Steve Moss

New Zealand schools make large investments in information and communication technologies yet few are effective in integrating ICT across the curriculum or in using it to develop higher order thinking and information skills. In this research project Steve Moss looked at how a range of schools is using ICT in the classroom, the obstacles and problems they faced and the strategies they developed. Based on his findings, he offers a model of best or effective practice to enhance learning through the use of ICT.

Introduction

In its *Information & Communication Technologies (ICT) Strategy for Schools 2002-2004 DRAFT* the Ministry of Education stresses the importance of teaching and learning with ICT (p4):

“The focus is on learning and teaching for a new generation – ... To focus on technical skills alone is to limit the vision of ICT in education. Rather, the focus must be on extending and deepening educational experiences ... ”

To equip a school with appropriate ICT tools can involve substantial funds. So where schools have spent extensively on ICT, and the principal and staff are heavily involved in promoting/sharing their ICT philosophy and expertise, there is a need to ensure boards of trustees remain convinced that such expenditure is justified through improved teaching and learning. The Education Review Office (ERO) has noted, in many of its reports, that it is necessary for boards to evaluate that their expenditure has increased the teaching and learning effectiveness in the school.

The aim of this research project was to identify strategies to improve teaching and learning effectiveness through the use of ICT. A literature review focusing on six aspects of ICT was undertaken. These aspects were:

- definition
- decision-making
- policies/planning
- access(for staff and students)
- professional development
- learning theories (higher order thinking skills).

In the second phase of the project, visits were arranged to schools/kura across the country, and questions and discussion were based on the six focus areas listed above. The final phase of the project was the completion of a report based on observations and discussions and the development of a model for best effective practice.

Reviewing the literature

In this paper ICT and computers are seen as one and the same thing although it is recognised that ICT is more than just computers. Some overseas researchers prefer to use the term “Educational Technologies”(ET), (which is not to be confused with Technology Education). In the United States, in particular, there is still scepticism about whether the “huge expenditure” on ICT has made a substantial difference to student learning. Both overseas and New Zealand research suggest that ICT programmes are often add-ons with little planning to integrate them across the curriculum. Researchers have identified a strong link between ongoing professional development of teachers and the integration of ICT in classroom programmes for the benefit of students’ learning.

Teachers also need to adapt their teaching styles from the traditional “sage on the stage” to a more student-centred approach of “a guide on the side”. The research has also identified access as a barrier to the development of effective ICT programmes. Barriers such as lack of training, support and inappropriate planning and leadership hamper teachers. One UK study showed that many students, particularly in primary, had better access at home than they did at school. Having access to a home computer enhanced teachers’ ICT capabilities. Researchers agree that the successful integration of ICT depends on how well schools and teachers can not only modify their programmes but learn to do “new things in new ways”. The Ministry of Education’s Draft ICT Strategy states: “When identifying purposes for their ICT developments, successful schools appear to go beyond technology, drawing on their knowledge of how people learn, higher order thinking, effective knowledge management, information literacy, teamwork and self-evaluation”.

Visiting the schools

Visits were made to a range of schools/kura in deciles 1-10 across the country. Direct contact was made via e-mail with these colleagues and schools. Schools/kura were provided with an outline of the six focus areas for questions and discussion. Visits mostly involved meeting with the principal. In some schools/kura classrooms were visited to observe programmes in action. The investigation focused on the six aspects of ICT identified in the literature review(see above).



Steve Moss fell in love with computers back in the 1980s when his school bought an Apple IIe. "According to my wife, I and the rest of the men teachers stood around and worshipped it." He dabbled briefly with programming, "but I very quickly found out that wasn't my thing. Somebody else could write the programs and I would try to use computers to help my students in their work."

Nearly 20 years on, he is still exploring ways to use them effectively in the classroom. Steve is a senior teacher (currently acting assistant- principal) in his sixth year at Chaucer School, a state contributing primary in Blockhouse Bay, Auckland. He holds responsibility for ICT throughout the school and the library.

"In our school we want to help our students develop higher order thinking skills and we are attempting to use ICT to do that," he says. In his research, which involved visiting schools up and down the country he found that few schools were doing that well. "It's a very slow process and the only way it will work is with lots of professional development. Professional development takes a number of years to actually become effective."

One of the problems is that some schools are not as well equipped as they need to be. "I think the government should originally have put more money into providing computers in schools. There needed to be a baseline for all schools. There's so many competing demands for school funds these days."

The ideal is having a mixture of pcs and Apple computers. "The schools I've seen who were doing things properly had a mixture. They buy computers for specific purposes." He is in two minds about recycled computers. "We bought some recycled computers but they're limited in what they can do. Unless your server is driving your network well, you need decent computers in the classroom."

A fast Internet connection can make a big difference. "The schools that are using Jetstream certainly found it easier. If you want to look at a website and you've got 20 classes in your school, and many children trying to access different things, it's got to be fast, otherwise you have to sit around waiting."

In the end, says Steve, ICT is just another tool. "You choose the best tools for the job – it might be the telephone, the Internet or a library book. If you can get into that frame of thinking and your students have that frame of thinking, it is much easier to integrate ICT across the curriculum."

Findings

ICT in the schools visited encompassed a whole range of technologies besides computers. Digital cameras (still/video), faxes, polycom phones were all readily mentioned by teachers. Some schools have their network linked to a digital photocopier. An exciting use of ICT was the video-conferencing suite set up as part of the wharekura. This kura, a composite school, had the suite provided under the Kaupapa Ara Whakawhiti Matauranga (KAWM) programme. Two North Island schools use video extensively. All the schools/kura were networked in some way. Most schools had a complete school-wide network. A number of networks were run using Linux. Others were using Windows and/or Apple servers. The installation and maintenance of the network is of critical importance. It is apparent that Apple servers, and Linux generally, cause fewer hassles for schools. Networks were used for communication (e-mails), a daily notice board, access to a variety of software, planning and administration, and sharing of students' work through Internet/Intranet access.

In most cases decisions about ICT plans and purchases were made by the principal, sometimes with the assistance of the ICT leader and/or the board of trustees. In many cases strategic plans were initially developed to access the funding available from the Ministry in the late 1990s. A number of schools used leasing as a means of funding their ICT hardware while others had developed their hardware through major fundraising exercises. Some schools had to face up to how they would replace their ageing ICT hardware. Other factors such as software, maintenance and training had to be covered in the ICT budget.

There are two aspects to planning. One is the planning for development and renewal of the ICT infrastructure in a school/kura. The other is the way ICT is used in curriculum and administration planning. While some schools had school-wide systems for planning using ICT others were beginning to develop such plans. A number of schools did not have a standardised planning master that incorporated a space for ICT opportunities.

One South Island principal had set in process a system where all planning was lodged electronically and no paper plans were accepted. In the wharekura an ICT team held regular hui to ensure that plans continued to be developed and programmes implemented, and provide support for fellow pouako. In one school the intranet contained pages essential for teacher planning. All intranets seen included student pages, teacher pages, information pages and links to other websites for both teachers and students. All schools had policies for ICT use in their school. In some instances these were being rewritten to take account of school developments, and to fit with new plans currently being formulated.

In all schools access to ICT was readily available for both teachers and students. Computers were available in all classrooms. Schools were networked, in some way, and these systems worked with varying degrees of success. It was apparent that the quality of, and the rapport developed with, technical support people are crucial to running a successful network. Another factor appears to be the commitment of the principal to keeping the system operating, through adequate funding, and scheduled release time for the ICT leader. The use teachers made of the computer/s in their classroom varied. In some classrooms the computer was not turned on, or not in use if turned on. Some classrooms use timetables that allow students to access the computers at appointed times. Programmes for use appeared to be limited by the teacher. The use of ICT in the schools observed varied from the creative to the mundane. A Year 8 class, for example, used its computer for a wide range of tasks: email, photo and word processing, publishing, Internet access and spreadsheets. Some classes in other schools were simply using their computers as word processors.

For teachers, access to ICT in all schools was available without restriction. However the skills and enthusiasm for using ICT tools varied widely. A number of schools are making use of data projectors. These are replacing the use of OHPs for many teachers. Some schools had provided laptops for their staff to use. This, when coupled with the use of a data projector, made for powerful use of ICT in teaching/learning programmes. In the wharekura access was enhanced through the provision of the video-conferencing suite and the expected arrival of another 40 computers (some in classrooms; some in a lab), provided through KAWM. The use of TV presentations was a feature of two North Island schools. These schools ensured that students undertook all aspects of the production, through supporting students with skills, and opportunities. One principal provided graphic evidence, using ICT, of the way participation in these activities had helped "reluctant" learners develop into skilled, successful learners.

All schools provided professional development (PD) for ICT but this was dependent

on the direction provided by the principal, and the school involvement, or not, in a ministry contract. In the wharekura a 15-minute slot was made available most lunchtimes when the ICT team would provide assistance with necessary skills development. One ICT leader spoke about the need for “just in time” professional development as the way their school operated. The in-service training may be from within the school, calling in outside training expertise, or visits to/by “experts” and courses.

The North Island lead school had developed a vision for learning which included questioning, thinking, and social skills, and was about to embark on numeracy skills. The major emphasis placed on being part of a learning community, and their developed model of inquiry learning has seen this school raise the standards of students’ achievement, and their belief in their ability to achieve, to high levels. Another large North Island school believes in a strong collegial approach to planning and decision-making. In this school professional development is extensive, and continual. Fewer and fewer schools are sending staff to day courses on ICT, which may be offering a broad coverage. More and more PD is being undertaken in-house and led by trained in-house “experts”.

In some schools learning theories that relate to higher order thinking skills (HOTS) are part of the professional development being undertaken. However in many schools there appeared to be no overall school philosophy that related to the use of these skills as part of the teaching and learning process.

A large North Island suburban primary has a school philosophy of using HOTS. All classes use de Bono’s Thinking Hats, and junior classes begin with three of them. This was one of only a few schools visited that demonstrated an overall school philosophy based on higher order thinking skills. Another North Island school uses de Bono’s Hats, multiple intelligences and action learning across the classes. All staff have had in-service training as a staff, and other individuals have had visits to other schools and day-course attendance to continue development. Some schools had had teachers involved in courses on multiple intelligences and were investigating how they could implement these in their programmes. Where suites are attached to libraries, and where library staffing is made available there appeared to be greater emphasis on using research skills, and the development of “rich tasks”. This was particularly so in a North Island school that provides a full-time information teacher as part of its library staffing.

Discussion

While most schools used a wide range of ICT technologies many do not yet seem to be utilising them to enhance teaching and learning through the use of higher order thinking skills. It was apparent from the observational visits that in sites where great care was taken to research the best ICT solutions those systems worked well. A broad range existed among schools in terms of the planning for ICT in their schools – from schools that had no across-the-school system for including ICT in unit planning to those where the use of ICT was a regular component of their planning.

All schools visited had good access to ICT. Some schools clearly had enthusiastic leaders who ensured that the use of ICT was embedded into school philosophies and programmes. In most schools visited teachers had computers in their classrooms to use for their classes as well as their administration work. A number had laptops, which they took home. In most schools access for students was available all day. In at least one school classroom computers were not being used – not even turned on in some classrooms. In

another instance it was noted that while children had access to the computer all day on a rostered basis, the activity appeared so structured that it was not obvious what the purpose of using the ICT was beyond another form of practising writing a letter. In all observational visits professional development was the one area where teachers were not satisfied with what they received.

A focus on higher order thinking skills was not seen across the school in most schools visited. It is considered that only three of the schools visited actually had an overall philosophy of using higher order thinking to enhance the learning of students through ICT.

A model for best or effective practice: integrating ICT across the curriculum

“Every day thinking, like ordinary walking, is a natural performance we all pick up. But good thinking, like running the 100-yard dash, is a technical performance ... Sprinters have to be taught how to run the 100-yard dash; good thinking is the result of good teaching, which includes much practice.”

David Perkins, Howard University
www.selu.edu/Academics/Education/TEC/think.htm

In the context of this paper *best* practice refers to a way in which integration of ICT can occur in school/kura settings. This model does not claim to be the best practice available, simply a model for best or more realistically, *effective* practice.

To ensure that integration of ICT occurs across the curriculum it is important that certain essential elements have been put into place. These include collaborative planning, “just in time” professional development in ICT skills in higher order thinking skills (HOTS), and leadership from the principal. Teachers and students with appropriate teaching and learning can learn these skills. As David Perkins’s quote says – technical performance can be learnt.

Joan Dalton, a keynote speaker at the ICT NAVCON2K2 conference held in July, insists that teachers should be “learning navigators not knowledge/student controllers” and that we have a pedagogical (the art, craft and science of learning) rather than a technological focus. When good thinking is learnt through practice then integration of ICT skills will be greatly enhanced.

Leadership

The leadership provided by the principal is the most important factor in determining whether or not ICT is integrated across the curriculum. The day-to-day authority to manage the ICT hardware may be delegated, but without the overt support of the principal for, and their practical assistance to, the ICT manager difficulties can arise that impinge on the ability to integrate ICT tools.

Collaborative Planning

In the schools where it was observed that integration was being established across the curriculum it was evident that planning for this was on a collaborative basis. When teachers own the plans for school-wide integration implementation occurs more easily.

Teachers need to plan co-operatively and know their students ICT skill levels, and have an identified achievement target or targets.

Melissa E Pierson (2001) exhorts teachers to plan to use ICT technology in appropriate educational settings to enhance integration.

“Our society does not simply need teachers who know how to use computers. We need exemplary teachers who know how to effectively use all the tools at their disposal for the learning benefit of students. According to the proposed definition of technology integration, technology in the hands of a merely adequate teacher will lack the experienced and thoughtful motivation necessary to embed it within a context of sound teaching practice. Conversely, technology in the hands of an exemplary teacher will not necessarily result in integrated and meaningful use. Unless a teacher views technology use as an integral part of the learning process, it will remain a peripheral ancillary to his or her teaching. True integration can only be understood as the intersection of multiple types of teacher knowledge and, therefore, is likely as rare as expertise. *Educational leaders would be well served to look beyond mere technology purchases and focus efforts instead on creating environments that are conducive to continued growth in pedagogy as well as in technology use.*”

Professional Development

Professional development (PD) of teachers is the master key to integrating ICT across the curriculum in our schools and kura. PD *per se* is not the complete answer. PD must be of the “just in time” variety rather than “just in case” which has been a common practice of the past. As teachers learn new skills and develop them they are able to make greater use of the ICT tools available to them in the classroom. Professional development must flow from the assessed needs of the teachers. Appropriate and sufficient funding must support it. The most appropriate personnel must deliver it. And the teacher, or teachers, must see the need for their participation. This information can be gathered in a number of ways eg: questionnaire; appraisal; teacher identification; needs of class.

The University of Newcastle was commissioned by the UK Teacher Training Authority to undertake a study on ICT and pedagogy. The project focused on how teachers make effective choices about when, when not and how to use ICT in teaching literacy and numeracy in primary schools. In a summary of their report *Ways Forward with ICT: Effective Pedagogy Using Information and Communications Technology for Literacy and Numeracy in Primary Schools* they state:

“that a key feature of the more effective teachers in the project was that they used examples and counter-examples when explaining to pupils, and that they modelled and demonstrated work to groups or the class ... used pupils to model and demonstrate what to do or what they had learnt in lessons ... This aspect of their teaching was also evident in activities which did not involve ICT. The project team believe that this reflects knowledge of their pupils as well as a detailed understanding of the specific subject objectives being taught.”

Professional development initiatives to promote the effective use of ICT need to take account of the diversity of teachers’ thinking and existing practice if they are to find appropriate “hotspots” for development. Successful professional development in technology happens both on a personal level and on a systemic, school-wide level.

Higher Order Thinking

“A good question is never answered. It is not a bolt to be tightened into place but a seed to be planted and to bear more seed toward the hope of greening the landscape of idea.”

John Anthony Ciardi (1916-86) American poet, critic
www.teachers.ash.org.au/researchskills/questions.htm

Higher order thinking skills are the key to integrating ICT in the school curriculum. These skills enable students to evaluate and select the most effective tools to allow them to locate, retrieve, process and present information to answer the questions they have posed. It would be pertinent, at this point, to define what is meant by higher order thinking skills. A selection of viewpoints follows.

Higher order thinking has been defined as using a range of thinking skills. A webpage for Louisiana teachers (www.selu.edu/Academics/Education/TEC/think.htm) provides a useful checklist to help teachers develop higher thinking skills in their students.

This website lists many ways for teachers to develop higher thinking skills in their students. The use of specific terminology in activities, be they formal written instructions or given orally, will assist this development. Such terminology follows (based on Bloom's Taxonomy):

- **Evaluation:** appraise, choose, compare, conclude, decide, defend, evaluate, give your opinion, judge, justify, prioritise, rank, rate, select, support, value
- **Synthesis:** change, combine, compose, construct, create, design, find an unusual way, formulate, generate, invent, originate, plan, predict, pretend, produce, rearrange, reconstruct, reorganise, revise, suggest, suppose, visualise, write
- **Analysis:** analyse, categorise, classify, compare, contrast, debate, deduct, determine the factors, diagnose, diagram, differentiate, dissect, distinguish, examine, infer, specify
- **Application:** apply, compute, conclude, construct, demonstrate, determine, draw, find out, give an example, illustrate, make, operate, show, solve, state a rule or principle, use
- **Comprehension:** convert, describe, explain, interpret, paraphrase, put in order, restate, retell in your own words, rewrite, summarise, trace, translate
- **Knowledge:** define, fill in the blank, identify, label, list, locate, match, memorise, name, recall, spell, state, tell, underline

Mark Treadwell in his New Zealand *i-learnt* (www.i-learnt.com) website also provides a similar list based on Bloom. He includes the question type, question stems and verbs/adverbs that are used in the questions. There is a wealth of information here about ICT and higher thinking skills and ways for teachers and learners to develop their skills.

David Perkins, quoted earlier, further asks the question: why is it important to develop higher order thinking skills? And in answer provides the following responses:

- In our increasingly complex and specialised society, it is becoming even more imperative that individuals are capable of thinking divergently and creatively. It is also important that individuals see the relationships between seemingly diverse concepts.
- Current brain research indicates that ... neurological differences account for learning and thinking differences among individuals. Some of the most creative

and influential thinkers of our time (Einstein, Churchill, Rockefeller, ...) have had characteristics of learning differences, including difficulty in completing simple, repetitive activities.

Further definitions of types of thinking are also provided.

- *Critical thinking* – This is convergent thinking. It assesses the worth and validity of something existent. It involves precise, persistent, objective analysis. When teachers try to get several learners to think convergently, they try to help them develop common understanding.
- *Creative thinking* – This is divergent thinking. It generates something new or different. It involves having a different idea that works as well or better than previous ideas.
- *Convergent thinking* – This type of thinking is cognitive processing of information around a common point, an attempt to bring thoughts from different directions into a union or common conclusion.
- *Divergent thinking* – This type of thinking starts from a common point and moves outward into a variety of perspectives. When fostering divergent thinking, teachers use the content as a vehicle to prompt diverse or unique thinking among students rather than a common view.
- *Inductive thinking* – This is the process of reasoning from parts to the whole, from examples to generalisations.
- *Deductive thinking* – This type of reasoning moves from the whole to its parts, from generalisations to underlying concepts to examples.
- *Closed questions* – These are questions asked by teachers that have predictable responses. Closed questions almost always require factual recall rather than higher levels of thinking.
- *Open questions* – These are questions that do not have predictable answers. Open questions almost always require higher order thinking.

Some suggestions are provided for fostering higher order thinking in the classroom:

1. Set up a classroom environment that is conducive to high-level thinking.

- *Multi-level materials* – eg for a Year 3 class provide materials that would be appropriate for Level 1 & 2, (likely most students) and Level 3 & 4 (some students). [Levels are NZ Curriculum Framework levels].
- *Flexible grouping* – groupings may be arranged beyond simple ability grouping. Try mixed ability; interest grouping; gender grouping; opportunities for pairs, individuals, and other groupings.
- *Accept and celebrate diversity* – not just in arts and crafts, story writing or music-making and physical education. But also in thinking. The divergent thinker should be encouraged, as well as critical and creative thinkers.
- *Print-rich environment* – ensure that lots of print material is available as – library materials; children’s published work – stories, poems, instructions, explanations, letters etc; vocabulary charts; print-saturated walls; variety of reading materials.
- *High expectations* – studies have shown that children perform to the level expected by the teacher. Teachers must tell students they are expected to perform to the best of their ability, (or better!)

- *Teacher as co-learner* – teachers need to ensure that they allow students to see that their own learning has not stopped and that we all can learn from each other – students can teach teachers.
- *Nurture risk-taking* – ensure that your students know they can offer responses that may not be “correct” or “valid” but that in doing so they should be able provide a reasoned response.

Joan Dalton, a Navcon2K2 keynote speaker, says that teachers should be using inclusive language and using open questioning to promote student thinking and participation. Open questioning allows for more than one kind of response. Students

- are provided with choice in the way to respond
- are empowered through choice
- (and teachers) foster respect for each other
- learn to value difference
- learn to make judgements based on their own values, and not on what they think might be acceptable to others.

2. Engage students in activities which foster high-level thinking.

- *Collaborative group activities in which students can communicate with others in a variety of ways.* In a North island school Year 3 children were creating their own multimedia show (using Hyper Studio). Children first prepared a storyboard of their show (mostly retellings of folk and fairy tales) so they were prepared to use the computers in the information centre when they visited as a class. In another school a group of children use e-mail, fax and/or phone to find out from other groups (same/different school) about the kinds of healthy food they have for their lunches. They also accessed the Internet; used spreadsheets; used digital cameras to show healthy food being eaten; presented the findings with PowerPoint on the school intranet; and used non-ICT activities, eg drama.
- *Develop problem-solving activities that require more than routine calculations.* Remember that the problem may not be numerical. Problems that involve constructing solutions (eg making a model) allow for students to use their ingenuity and creativity to develop possible solutions. Here is an example from Education Queensland Years 1-3 *Rich Task #2 – Multimedia Presentation of an Endangered Plant or Animal*. “Students will investigate a threatened Australian plant or animal and the extent to which it is at risk. They will use this investigation to take constructive action and create a persuasive and informative multimedia presentation.”
- *Open-ended activities with more than one “right” answer.* Students, and teachers, need to have it confirmed that an answer, while not technically valid, is not necessarily a wrong answer. Teachers should use “response language” that enables students to feel valued for their answers. This helps students to develop a rationale for making responses that are acceptable even when they may be unsure as to the validity of their response. Students should also be taught how to “justify” their decisions – which demonstrates the way they think. Here is an example from Education Queensland Years 1-3 *Rich Task #4 – Read and Talk About Stories*: “Students will view, read and listen to fiction stories presented in different media forms. They will analyse characters and settings and compare

different stories and different media, incorporating their own experiences. They will present their ideas in a performance using a selected combination of words, visual images, music and drama.”

- *Activities which accommodate multiple intelligences.* Expect students to experience a variety of activities – provide opportunities for reading; writing; speaking; drama and role-playing; music-making; constructing models; picture making; etc. Another way to accomplish this is to ensure that activities are designed for each of the categories of multiple intelligences. A school visited as part of the research project expected that units of work would incorporate activities that fitted with each of Gardner’s multiple intelligences so that students experienced various ways of learning – eg a visual learner would experience a kinaesthetic activity, and so on.
- *Activities in which both genders participate freely.*

3. Construct questions that call for high-level thinking.

- *Ask yourself, “Do I always know the answer to my questions?”* Use a variety of assessment methods that match teaching strategies. For example, use a project for assessment instead of an end-of-unit test.

Conclusion

At the Navcon2K2 Conference, hosted by the Ministry of Education and the Navigator schools of Australia, there was a focus strand on learning. This focus concentrated on higher thinking skills and how teachers must implement these to continue to ensure that students have the appropriate skills to help them survive in our information age. Effective practice in integrating ICT across the curriculum ensures that schools/kura have well-developed procedures for providing leadership, collaborative planning by all staff involved in using ICT, professional development that addresses the properly assessed needs of teachers and their students, and with a focus on learning and teaching that utilises higher order thinking skills.

APPENDIX

Some More Useful Internet Links

On a webpage at the North Central Regional Educational Laboratory, seven higher order thinking skills reported from The Learning Research and Development Center (1991) are listed. These can be viewed at www.ncrel.org/sdrs/areas/issues/students/atrisk.htm

Paul, Binker, Jensen, and Kreklau (1990) have developed a list of 35 dimensions of critical thought which can be viewed at www.ncrel.org/sdrs/areas/issues/envrnmnt/drugfree.htm

The Covington webpage on CHMS Staff Development: Teaching Higher Order Thinking Skills is based on Bloom’s taxonomy. www.k12.vt.us/chm/teachres.htm There is a definition of creative and critical thinking and the need for specific planning. Creative thinking is the creation or generation of ideas, processes, experiences or objects; critical thinking is concerned with their evaluation.

An Australian website has excellent ideas for using higher order thinking skills. They insist that:

“...thinking activities need to be planned and scaffolded. Students need to be aware that they are thinking (meta-cognition) and that different thinking strategies are required for different problems...”

and quote Edward De Bono who believes that:

“...many highly intelligent people are bad thinkers. Intelligence is like the horsepower of a car. A powerful car has the potential to drive at speed. But you can have a powerful car and drive it badly. Thinking is the driving skill with which each individual drives his or her intelligence.”(Mind Power 1995) www.teachers.ash.org.au/researchskills/default.htm

The Queensland Government has developed The New Basics which is based on “rich tasks”. The website contains examples of planning, tasks, assessment ideas. <http://education.qld.gov.au/corporate/newbasics/>

Some other websites that deal with higher thinking skills are:

1. www.covington.k12.tn.us/resources/word/hots1.htm
2. www.covington.k12.tn.us/resources/teacherr.htm
3. www.mdk12.org/practices/good_instruction/projectbetter/thinkingskills/introduction.html
Thinking and Learning ~ Project Better ~ Best Practices ~ School Improvement in Maryland
4. www.criticalthinking.org/default.html The National Council for Excellence in Critical Thinking.

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Note: This is an edited version of Steve Moss's paper. The complete text is available on the NZEI Te Riu Roa website www.nzei.org.nz