INFORMATION AND COMMUNICATION TECHNOLOGIES:
APPLICATIONS FOR EFFECTIVE LEARNING AND TEACHING

Do you “chat” to people in real time over the Internet while you download a personal selection of music to your MP3 player? Do you use a digital camera on the weekend that you connect to your home computer to print photos? Is mail delivered to your computer or mobile phone, with bills and “junk mail” being about all you receive in your physical letterbox? When did anyone in your family last attend to their financial business in person rather than through a phone line? Do you usually withdraw cash over a counter in a bank or do you get by with only a small amount of “real” money? “No need,” you say; “after all, you can pay for just about everything with a little plastic card linked to a mainframe computer somewhere, even your food at McDonald’s.” Welcome to the digital information and communication era!

This is the end of teaching as we know it. We're no longer providing a service to our students as much as we are facilitating their own learning. And that's now our most important job because for the first time, it can happen that way. That doesn't mean that we stop teaching altogether, but it does mean that our ideas about teaching have to change when the tools of content creation have been placed in the hands of the learners themselves. (Richardson, 2005: On Being Radical - http://www.weblogg-ed.com/2005/12/02)

Today’s educators would have to agree with Richardson’s comment – traditional teaching methods, where information is transmitted to learners, is no longer relevant in a world where up-to-date information from a wealth of independent sources is available at the touch of a computer key. Elliott (2004) points out, however, that although Information and Communication Technologies (ICT) have the potential to enhance learning environments, capture students’ attention and interest, and improve learning outcomes where teachers use them it is for developing basic skills, retrieving information and managing tasks. Consequently, students are not taught the necessary thinking skills to participate in the knowledge culture and economy of today and tomorrow.

These important skills are outlined overleaf:
## Thinking Skills Needed for a Knowledge Culture and Economy

<table>
<thead>
<tr>
<th>Information Processing</th>
<th>Reasoning Skills</th>
<th>Enquiry Skills</th>
<th>Creative Thinking</th>
<th>Monitoring and Evaluating</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Identifying and analysing relationships between pieces of information</td>
<td>4. Making judgements and decisions informed by reasons or evidence</td>
<td>4. Predicting outcomes and anticipating consequences</td>
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</tbody>
</table>
Educators who grew up in a pre-computer, pre-Internet world are painfully conscious that there is a considerable distance between them and their students. Marc Prensky describes those born after the Internet became commercially available (early 1990s) as Digital Natives who are “native speakers” of the digital language of computers, video games and the Internet, and who “think and process information fundamentally differently from their predecessors” (Prensky, 2001). The rest of us are Digital Immigrants who try to assimilate into the new digital world by learning to use digital technology, but who still have their foot in the past, shown, for example, when we phone someone to ask “Did you get my email?” or print out documents we are writing so that we can edit them - http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf

The advent of the Internet has spawned a proliferation of “virtual” schools, classrooms, and communities interconnected across the planet. In its wake, a plethora of challenging questions has surfaced:

- What knowledge do educators and parents need to have to make effective choices about how to facilitate their students’ learning though ICT?
- To what extent will the use of home computers and mobile technology by young people affect their cognitive, social, emotional and physical development?
- How much will learning and teaching increasingly take place in cyberspace, removing the necessity to attend formal classrooms?
- Will educational institutions continue to remain conservative in their use of ICT and serve as havens from the rapid assaults of their computer-generated sounds and images?

It would be foolish to suggest that most educators use computer technology in their learning environments, let alone have expertise in the many applications that are available. While recognising that learning can occur without direct teaching, in this chapter we consider the ways in which educators can use computers and telecommunications to enhance their teaching and provide access to learning opportunities for a greater range of students than might otherwise be possible.
Imagine that you are a newly graduated teacher applying for a position in an early childhood, school or higher-education setting. During your interview, you are asked to describe both your proficiency in using ICT and the purposes for which you would use it for teaching and learning. What would you say?

Before you answer this, consider the definition of ICT literacy adopted by MCEETYA, which comprises all Australian state, territory, and federal education ministers, in preparation for assessing the ICT literacy of Year 6 and Year 10 students in Australia from the end of 2005:

The ability of individuals to use ICT appropriately to access, manage and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society.

(ICT AND THE NATIONAL GOALS OF SCHOOLING -

Australia’s young people will be assessed as being ICT literate if they can demonstrate proficiency in the following six processes:

1. **Accessing information** — identifying the information needed and knowing how to find and retrieve information.
2. **Managing information** — organising and storing information for retrieval and reuse.
3. **Evaluating** — reflecting on the processes used to design and construct ICT solutions and about making judgements regarding the integrity, relevance and usefulness of information.
4. **Developing new understandings** — creating information and knowledge by synthesising, adapting, applying, designing, inventing or authoring.
5. **Communicating with others** — exchanging information by sharing knowledge and creating information products to suit the audience, the context and the medium.
6. **Using ICT appropriately** — making critical, reflective and strategic ICT decisions and about using ICT responsibly by considering social, legal and ethical issues.

How well would you score on these processes? Could you claim to be ICT literate?
Instructional Purpose Influences the Choice of ICT

ICT can support many instructional purposes, depending on the pedagogical model adopted. Roblyer (2006) outlines how these instructional uses will vary for directed instructional models of teaching and learning, and constructivist models. These differences are outlined in the table below, which is adapted from Roblyer at [http://www.prenhall.com/roblyer](http://www.prenhall.com/roblyer):

<table>
<thead>
<tr>
<th>Directed Instructional Models</th>
<th>Constructivist Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Teacher transmits a set body of knowledge to all students.</td>
<td>1. Teacher designs complex problem situations for students to explore, discover, and generate understanding.</td>
</tr>
<tr>
<td>2. Teacher use lectures, demonstrations and practice tasks to help students understand, remember and apply new information and skills.</td>
<td>2. Students actively construct knowledge through their own experiences in real-life contexts.</td>
</tr>
<tr>
<td>3. Teacher presents the information and skills that is to be learned in a structured sequence.</td>
<td>3. Students explore and discover with no strict structure or sequence.</td>
</tr>
<tr>
<td>4. Teacher gives students individualised work.</td>
<td>4. Students work in collaborative or cooperative groups.</td>
</tr>
<tr>
<td>5. Students must achieve the same set of specified objectives.</td>
<td>5. Teacher sets open-ended learning goals that may differ for each student (e.g., problem solving; higher-order thinking skills).</td>
</tr>
<tr>
<td>6. Students must master all prerequisites for each new skill.</td>
<td>6. Students acquire lower-order thinking skills progressively through solving problems that require complex thinking skills.</td>
</tr>
</tbody>
</table>

Having read above how the instructional purposes of each model vary, think about the different ways in which ICT could be integrated to suit each purpose. In the figure below, Roblyer (2006) suggests some possibilities.
## Teaching Models and Associated ICT Integration

<table>
<thead>
<tr>
<th>Directed Instructional Models</th>
<th>Constructivist Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directed instructional models use tutorial, drill-and-practice, and concept revision game software to:</td>
<td>Constructivist instructional models use videos, graphic tools, desktop-publishing, Internet research, simulations and problem-solving software to:</td>
</tr>
<tr>
<td>1. Correct specific skill deficits and learning weaknesses such as with at-risk students.</td>
<td>1. Foster creative problem-solving and develop metacognitive strategies.</td>
</tr>
<tr>
<td>2. Enhance overlearning through practice so that subskills become automatic.</td>
<td>2. Build conceptual links though visual models to enhance knowledge transfer to new contexts.</td>
</tr>
<tr>
<td>3. Adapt instruction to individual differences in skill and ability.</td>
<td>3. Boost student cooperation through group learning structures.</td>
</tr>
<tr>
<td>4. Provide support for self-paced learning for students who need enrichment activities.</td>
<td>4. Take advantage of different talents and strengths (multiple intelligences) when solving problems.</td>
</tr>
</tbody>
</table>
Research-based Reasons for Using Computer-based Technology in Educational Environments

Of course, being told as educators to use computers for teaching and learning is one thing; being convinced that this is a good idea is another. Roblyer (2006) outlines a number of significant reasons for using computerised instructional technologies in educational settings that have emerged from recent research.

1. It is motivating because:
   - learners’ interest, attention and enthusiasm can be captured and maintained by the visual appeal and interactivity of programs;
   - learners’ perceptions of control over their learning are increased, especially for at-risk students - intrinsic motivation is consequently fostered;
   - learners can create their own professional looking products which boosts confidence and pride in their work.

   It is useful to note here that extensive research by Passey et al. (2003) confirms that ICT use has positive impacts on pupils’ motivation to learn, but only if students are provided with clear task orientations for its use. In this context, an outstanding summary of the motivational effects of ICT use can be found at:


2. It provides unique instructional capabilities because:
   - learners can obtain rapid access to extensive information resources not otherwise possible through traditional means;
   - presentation of information in powerful visual ways such as simulations, virtual reality and other 3-D visualisation, allows learners to understand and explore complex topics at deeper levels;
   - electronic monitoring of learners’ performances following instruction by teachers can provide formative and summative evaluation of their learning processes and accuracy, as well as immediate feedback.
3. It supports new instructional approaches because:

- cooperative group projects can be facilitated by computer-based technologies - interdependence and individual accountability within groups can be built into the design of learning activities using multimedia and vast databases;
- intellectual resources (“intelligences”) are distributed between learners and technological tools, thereby expanding the goals of education from individual achievements to those shared by communities of learners. In this context, look up the use of Interactive Whiteboards in Learner Centred Teaching at this site: http://www.tsof.edu.au/research/Reports05/measday.asp
- problem-solving and higher-order thinking are developed through complex projects facilitated by access to the Internet and multimedia.

In the context of the previous two points, Ron Owston has conducted a great deal of research over the last ten years on the factors that affect use of ICT to support “deep” learning. His publications are well worth your time to read, especially if you are interested in the ways in which Communities of Practice and contextual factors impact the success of ICT adoption in schools where student self-directed, inquiry-based learning flourishes: http://www.edu.yorku.ca:8080/~rowston.

4. It increases teacher productivity because:

- computer-based tools provide efficient means of record keeping and instructional management as well as preparation and presentation of learning and teaching activities;
- e-mail, electronic bulletin boards, listservs (discussion groups), weblogs, and videoconferencing provide opportunities for rapid professional exchange;
- test-generating software reduces the time needed to prepare and assess tests in different formats from multiple choice and short answer to essays, which are completed on paper or on-line;
- software exists to facilitate and update the design of Individual Educational Plans (IEPs) for learners with special needs.
5. It provides opportunities to develop literacies needed for an Information Age because:

- technological literacy will continue to be necessary for vocational opportunities and lifelong learning skills;
- visual literacy is increasingly required to interpret and communicate information presented through instructional technologies;
- critical information literacy is necessary to locate appropriate sources of information on the World Wide Web, and evaluate their reliability, validity and currency.

What do you think your computer competencies are at this stage in relation to the three required literacies for the Information Age: technological, visual and information? What do you still need to learn? How do you plan to do this in the short- and long-term?

**Connectivism Theory**

In *Connectivism: A Learning Theory for the Digital Age*, George Siemens (2005) [http://www.elearnspace.org/Articles/connectivism.htm](http://www.elearnspace.org/Articles/connectivism.htm) presents the reader with an alternative theory of learning (connectivism) from those of behaviourists, cognitivists and constructivists, which is formed through the integration of chaos, network, complexity and self-organisation theories.

According to Siemens (2005, p. 5), the following are the main principles of connectivism:

1. Learning and knowledge rest in diversity of opinions, not a single source.
2. Learning is a process of connecting specialized nodes or information sources.
3. Learning may reside in non-human appliances.
4. The capacity to know more is more critical than what is currently known.
5. Nurturing and maintaining human networks is needed to facilitate continual learning.
6. The ability to see connections between fields, ideas, and concepts is a core skill.
7. Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
8. Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.
As Siemens explains, connectivist theory accounts for the new ways in which learners gain and create knowledge through the use of ICT. According to Chris Dede, the learning styles of students have also begun to evolve as a function of the digital age, as he explains in *Planning for Neomillennial Learning Styles* - [http://www.educause.edu/pub/eq/eqm05/eqm0511.asp?bhcp=1](http://www.educause.edu/pub/eq/eqm05/eqm0511.asp?bhcp=1)

One site worth looking at that clearly applies the principles of connectivist theory and accommodates “neomillenial learning styles”, is that of Xplora, a very up-to-date European site designed to motivate students in learning science. Explore for yourself - [http://www.xplora.org/ww/en/pub/xplora](http://www.xplora.org/ww/en/pub/xplora)

**Visual Learning Tools**
The instructional effectiveness of graphic organisers for improving student learning and performance has been shown in the following areas:

1. Reading comprehension.
2. Thinking and learning skills such as organising and communicating ideas; seeing patterns and relationships; and categorising ideas.

The use of graphic organisers clearly supports the implementation of cognitive learning theories: dual coding theory, schema theory and cognitive load theory. You can try out the free (for 30 days) downloads of INSPIRATION and KIDSPARATION graphic organiser software at: [http://www.inspiration.com/freetrial/index.cfm](http://www.inspiration.com/freetrial/index.cfm)

**What is Visual Learning?**
Visual learning techniques - graphical ways of working with ideas and presenting information - teach students to clarify their thinking, and to process, organise and prioritise new information. Visual diagrams reveal patterns, interrelationships and interdependencies. They also stimulate creative thinking.
Visual learning techniques help students:

- **Clarify thinking.** Students see how ideas are connected and realise how information can be grouped or organised. With visual learning, new concepts are more thoroughly and easily understood.

- **Reinforce understanding.** Students re-create, in their own words, what they have learned. This helps them absorb and internalise new information, giving them ownership of their ideas.

- **Integrate new knowledge.** Diagrams updated throughout a lesson prompt students to build upon prior knowledge and internalise new information. By reviewing diagrams created previously, students see how facts and ideas fit together.

- **Identify misconceptions.** Just as a concept map or web shows what students know, misdirected links or wrong connections reveal what they don't understand.

http://www.inspiration.com/vlearning/index.cfm

The Games People Play

The wealth of software available today, packaged as computer games for home education, reinforces what educators have known for a long time - that learning can emerge from play which is fun and motivating. In many games, therefore, there are no apparent rules so that the only way to learn how to play them is through immersion in the game (think about what we have said earlier about radical constructivism in this context). This is an example of the role of discovery in learning and the principle of inductive reasoning, where individuals construct hypotheses or rules from examples collected from their experiences.

Nowadays, software using such an exploratory approach is being specifically designed for very young children. Even one- to two-year olds can learn through random exploratory acts to “use” a computer mouse and keypad with games such as *Sesame Street Baby and Me*

http://www.superkids.com/aweb/pages/reviews/multisub/baby/1/babyme/merge.shtml

while kindergarten children are also encouraged to engage in exploratory play with specially designed software such as *Paint, Write and Play*

http://www.worldvillage.com/wv/school/html/reviews/pwp.htm, and *Reader Rabbit*

The challenge clearly exists for both parents and educators to understand the nature of these games and to evaluate the extent to which they are truly “educational” rather than merely entertaining. Certainly, it would be well to remember that the corporate world is keen to persuade parents that their children will be “left behind” economically through missed life chances if they are not proficient with computer technology in the world of the future.

Some interactive adventure games, like *Myst* [http://www.justadventure.com/articles/AdventuresInEducation.shtm](http://www.justadventure.com/articles/AdventuresInEducation.shtm) foster the development of problem-solving skills through totally unguided exploration. *Myst* does not come with a set of rules; it is for the users to discover the secrets of the deserted island from clues they pick up and explore: magical maps, segments of books and hidden rooms. Simulations such as *SimCity* [http://www.mediafamily.org/kidscore/games_sim_city_4.shtml](http://www.mediafamily.org/kidscore/games_sim_city_4.shtml) and *Civilization IV* [http://www.gamespot.com/pc/strategy/civilizationiv/index.html?sid=6136659](http://www.gamespot.com/pc/strategy/civilizationiv/index.html?sid=6136659) and *Civilization IV* [http://www.gamespot.com/pc/strategy/civilizationiv/index.html?sid=6136659](http://www.gamespot.com/pc/strategy/civilizationiv/index.html?sid=6136659) are also examples of open-ended, problem-solving games where users construct their cities or civilizations by taking into account a range of complex, interrelated factors (as in the real world), such as population, religion, trade, traffic, disease and climate.

One of the most highly awarded sites for young people aged 12 and under to engage in “playful learning” and gain “technological fluency” is *MaMaMedia* - [http://www.mamamedia.com/](http://www.mamamedia.com/). At this site, “grown ups” are also encouraged to explore and participate in the activities of their children, and are provided with guidance about the learning value of these activities – [http://www.mamamedia.com/areas/grownups/new/home.html?src=sdw](http://www.mamamedia.com/areas/grownups/new/home.html?src=sdw)

If you are keen to understand more about the enormous impact of computer-based games on the learning and development of children and young people, you should definitely look at the recent and comprehensive Games and Learning Handbook written by Sandford and Williamson (2005) at [http://www.nestafuturelab.org/download/pdfs/research/handbooks/games_and_learning.pdf](http://www.nestafuturelab.org/download/pdfs/research/handbooks/games_and_learning.pdf)
Freeing the Gifted Learner

As we have outlined in Chapters 3 and 4 of the text, there are many differences in the ways that learners process and retain information. It is vital for educators to assist learners in understanding new information through as many “channels” as they can. In this context you should read the following article on how gifted visual spatial learners can “suffer” in a traditional learning environment where material is presented to them through words, whereas they “think in pictures” –


Nowadays, even the previously accepted definition of “art” is being challenged at its core by new digital technologies. How exciting it is for those individuals who can now use these alternatives to paint and paper as means of expressing and developing their visual intelligence. See: http://theage.com.au/articles/2006/03/08/1141701518743.html?page=3. Digital video software has similarly opened up many opportunities for learners to collectively research, problem-solve and create products that demonstrate their visual literacy and insights into a topic: http://www.tsof.edu.au/resources/video

As Microsoft is keen to illustrate in the two websites below relating to multiples intelligences and learning styles, there are many computer-based tools to support learner preferences for coding information, and for expressing their understanding:
http://www.microsoft.com/uk/education/learning/multiple-intelligences/
http://www.microsoft.com/uk/education/learning/learning-styles/

In the context of supposed learning advantages for students in presenting material via hypermedia, however, Dillon and Gabbard (1998) reported that “passive learners” who rely on memorisation and rehearsal, those who are surface processors of information or have low ability, are at a disadvantage. This is because hypermedia lacks explicit cues to provide structure and a sense of control (also important factors for anxious learners). On the other hand, those who are “deep processors”, have high ability and are willing to explore, do well with information presented as hypermedia. The lack of explicit structure in the information environment supports their developing understanding and transfer of concepts. Rand Spiro’s Cognitive Flexibility Theory is worth referring to in this regard: http://phoenix.sce.fct.unl.pt/simposio/Rand_Spiro.htm
Just as higher-level thinking skills and metacognition can be fostered through the teacher’s use of higher-order questions and sufficient wait-time (at least three seconds), computer programs that include higher-level questions or prompts can achieve the same result. See the following article -  

It would be beneficial, therefore, to select software that has these features such as outlined in the following site. Many such “mindtools” that have been developed and refined over the last 15 years to support constructivist pedagogy are described in detail, along with the theory underpinning them, in David Jonassen’s (2000) Computers as Mindtools for Schools.

In his most recent (2006) book, Modeling with Technology, Jonassen further explains how learning and conceptual change can occur through building, manipulating and experimenting with models through software such as databases, spreadsheets, concept maps, visualization tools, and hypermedia - see the related resources for both of Jonassen’s books at the companion website:  
http://www.prenhall.com/jonassen/.

Freedom to Write

For many learners who find little appeal in writing, there are significant advantages in providing them with access to word processors. These include:

- **freedom** from the mechanical concerns of poor handwriting, corrections and spelling, which enables them to concentrate on the flow of ideas. This fosters learners’
- **motivation** to write because it is fun, physically easier (due to the range input devices and screens available. This leads to improvement in the
- **quality** of written work, especially for weak writers, and the encouragement to write longer documents.

**Clicker 5** is an award-winning program that enables students of all abilities to develop skills in reading and writing English, using words, pictures, sounds and phrases -  

From a constructivist perspective, using the computer as a writing tool changes the traditional, classroom-based, writing instruction to one in which students have greater independence and initiative, with a skilled teacher and peers acting as facilitator, adviser and editor - a Vygotskian (dialectical) approach to learning. Furthermore, using a word processor encourages greater spontaneous
collaboration and cooperation between peers in the writing process as a function of the “public nature of computer writing” (Snyder 1993, p. 21).

Management of Teaching

Many management functions can be handled effectively by computers thereby freeing the teacher from numerous non-instructional tasks to concentrate on learning activities. Examples of these are:

- keeping records of student progress;
- drafting and keeping a record of individualised correspondence to students and parents;
- keeping attendance records;
- maintaining inventories of classroom equipment and materials;
- designing tests, answer sheets, worksheets and individualised learning contracts;
- producing posters, calendars and class awards;
- generating student reports to parents.

Assessing Understanding

Educators would agree that standardised tests allow students to show their recall and use of factual content without actually understanding it. The nature of any prior knowledge, misconceptions and misunderstandings underlying students’ responses is likely to remain hidden, however. In other words, the complex processes used for procedural understanding cannot be diagnosed and assessed.

As McFarlane, Williams and Bonnett (2000) point out, “While national assessments continue to reward specified content knowledge above knowledge building abilities, the use of ICT will continue to cause tensions in the classroom”. These authors raise this issue in the context of their convincing case for students using multimedia authoring tools to demonstrate their (mis)understanding of subject matter:


From a constructivist perspective, multimedia tools allow educators to assess:

- not only the information students that accumulate and present, but the nature of the links made and networks set up between nodes of information (Loveless, 1997).
• incorrect ideas that have been included, correct ideas that have been omitted, and the thinking processes that underpin them both: categorisation, sequencing, describing procedures, deduction and inference (Doughty et al., 1994).

Education On-line

It would not be an exaggeration to say that most Western universities and many schools now provide courses on-line. For many students, this facility allows for learning opportunities that would be restricted otherwise by distance, illness or disability, family commitments, or the financial need to work full-time and study part-time. For institutions, the rise in on-line tertiary courses and degrees represents a marketing strategy to attract students and be able to “teach” them in greater numbers at flexible times with increasingly shrinking financial resources. Many educators have grave concerns about the pedagogy that underpins on-line teaching. It is very early yet to predict what “distance”, “flexible” and “blended” online and face-to-face learning will look like in the next few years in comparison with their largely asynchronous formats now. In a review of research evidence that has emerged in the area of tertiary courses on-line, however, Hall, Watkins and Ercal (2000) report the following:

1. Students in web-based tertiary courses perform as well as those in traditional classes, based on tests and class grades.
2. Learner variables play an important role in selection of, and performance in, web-based courses: those who select web courses are more computer-“savvy”, older, and are in some cases, academically better students.
3. Students in web-based courses are more likely to drop out; indicating that self-motivation may be a more important factor in performance in web-based classes than in traditional classes.
4. Factors that lead to improved performance in face-to-face classes such as structured collaboration and active learning also increase performance and positive attitude in web-based courses.

People Need People

As distance learning becomes increasingly interactive using video, audio and virtual reality systems, the quality of the interaction between teachers and students, and between learners themselves will continue to improve (Roblyer & Edwards 2006). Already Facemail [http://www.lifefx.com/main.html](http://www.lifefx.com/main.html) has been developed to allow a digital (your own or a stand-in’s) face to be projected “speaking” your e-mail
messages (which you have recorded on your computer through a microphone) to the recipient on their screen. Such expensive technology has been developed for commercial purposes as a consequence of the downturn in electronic commerce (buyers want the human touch, so you can choose “sensitive”, “slick”, “wholesome”, “enthusiastic”, “radical” or “intense” animations). Of course, educational adaptations for collaborative learning could follow.

Good Things Happen Between Schools and Communities On-line

An exciting initiative that can be successful in its outcome only through the Internet is the Better World Project [http://www.betterworld.net](http://www.betterworld.net). Part of his project has emanated from the United Nations Organisation’s declaration of the first International Day of Peace on 21 September 2006 [http://www.betterworldcalendar.com/peaceday.htm](http://www.betterworldcalendar.com/peaceday.htm). Not only does this site represent an opportunity for schools to participate through collaborative peace projects, it is one for all nations to communicate as one global “voice”.

An outstanding example of how educational communities around the world can connect via the Internet for their mutual enrichment can be found at the site of iEARN, the International Education and Resource Network [http://www.iearn.org/](http://www.iearn.org/) which has been operating since 1988.


Electronic Journals as Learning Spaces

Students in many educational settings, especially adult learners, have long been encouraged to keep reflective learning logs or diaries. Now that the technology exists, they can create “authentic” electronic learning journals in the form of weblogs – a diary kept on the web. An effective example of such a dynamic weblog about learning journals themselves can be found at [http://www.binaryblue.com.au/elj/](http://www.binaryblue.com.au/elj/). In the context, a research-based evaluation of learning journals is to be found at [http://www.usq.edu.au/electpub/e-jist/docs/Vol7_No1/CurrentPractice/Blogs.htm](http://www.usq.edu.au/electpub/e-jist/docs/Vol7_No1/CurrentPractice/Blogs.htm).

Excellent sources of links to ideas on the educational value of weblogs are available at the following Education Department site, as well as to the important issues of Internet access, privacy and
Computers as Personal Learning Resource

A markedly different model is exemplified in schools where the goal is for every student to have a computer as a personal learning resource. This is the philosophy underlying school initiatives in which parents are asked to purchase laptop computers for their children to use both at home and at school. The justification given is that portable computers should be seen as resources for enhancing the processes of learning and teaching in the same way as pencil and paper. Rather than being seen as tools for enabling the learner to be more productive and efficient (a business metaphor often used for the computer) the personal laptop computer can enable learners to develop their own idiosyncratic knowledge. The following site provides access to research that supports the learning value of portable ICT devices:


Most recently, portable handheld computers known as Personal Digital Assistants (PDAs) have begun to offer educators a simple way of having students record ideas, send e-mails and search the Internet when they are away from their desks. Think about the potential for students on field trips or for cooperative group work outside of classrooms after which they can connect their palmtop devices with desktop computers to transfer and analyse data. Teachers now also have a small, simplified, portable tool to store records such as attendance and achievement scores when away from the classroom.

The Center for Technology in Learning, whose excellent website you should view at http://www.sri.com/policy/ctl/html/synthesis1.html, provides a good source of practical advice for educators who wish to enhance their students’ learning through handheld technology is at ftp://download.intel.com/education/handhelds/SRI.pdf. In addition, you can find current research articles on Wireless Internet Learning Devices (WILDS), which show how these tools can change the way classroom collaboration takes place (students can SMS each other and the teacher for academic purposes) as well as the efficiency with which instructors can evaluate student understanding - http://ctl.sri.com/publications/downloads/UnlockingWILDs.pdf.

Considerable research evidence on the multiple benefits of students using handhelds has also emerged over the last few years. In this context, you should look at the Becta (2004) report: What the research says about portable ICT devices in teaching and learning at:


http://www.concord.org/work/themes/handhelds.html

**Digital Divide as Knowledge Gap**

Until now, the definition of the “digital divide” has referred to lack of hardware accessibility by those who cannot afford it, or are denied access to it. As digital technology has become increasingly affordable and available, however, the term has come to refer to the knowledge gap caused by limited ICT literacy and the absence of the range of cognitive skills that optimise technology use which many would argue are vital to function in a global community increasingly dependent on IT. The consequences for those who lack such access are social exclusion from participation in determining their individual and collective life chances (see Warschauer (2002) at:


Increasingly, schools are providing laptops for daily student and teacher use, especially where a large proportion of students come from disadvantaged homes. In doing so, ICT literacies are developing rapidly, along with improved learning, teaching and communication. Once such site is Arthur Phillip High School - http://www.aphs.nsw.edu.au/.

Although a large number of students report having access to a computer at home, they seem to use it mainly for entertainment, chatting, and to access the Internet for information. There are still too few computers for individual use in most classrooms. Increasingly, projects around the world are being set up to determine the learning value of providing all students with a handheld computer for use at school and home.

Many would argue that, while it may be advantageous for all students to have their own portable computer, it is unrealistic to think that this is feasible because of the huge expenses involved for schools and parents. This may not be the case in the future. Increasingly in the USA we are reading about the mega corporations who are “donating” or subsidising the equipping of whole schools and even families with computers. In Australia, one not-for-profit agency is working to bridge the divide between the information rich and the information poor. This is Green PC, whose technicians refurbish donated, surplus computers and sell them to those who can demonstrate that they are financially disadvantaged - http://www.greenpc.com.au/
Digital Inclusion

In its “early days”, the use of the Internet for educational purposes was available to the privileged few who could afford the hardware and software, and pay the access fees. Most recently, collaborative research efforts have begun to extend the opportunities provided by the Internet to societies that are unable to afford the newest technology. One such joint effort is that of the Massachusetts Institute of Technology (MIT) and the Instituto Technologico de Costa. The aim of this ostensibly philanthropic venture is to build inexpensive (using recycled local materials), portable “Little Intelligent Communities” (LINCOS) so that “from the most remote mountaintop to the least accessible jungle, every under-developed region of the world can be linked to the latest educational, medical, commerce and arts services” (MIT 1999, http://web.mit.edu/newsoffice/nr/1999/crate.html). Some would say that such access is a mixed blessing. The “privilege” of access to educational technology will certainly assist many students in poor communities to acquire skills needed for local and global communication and even to find employment in a digital age. With that, however, is the probability that the technological divide will continue to widen as a function of wealth—we suggest that you read the very insightful commentary on issues of social justice and global telecommunications provided by Fabos and Young (1999).

Many valuable sites relating to international efforts to provide digital inclusion for disadvantaged communities can be found at http://lanic.utexas.edu/la/region/digitaldivide/

In terms of breaking down the digital divide internationally, the good news is that Nicholas Negroponte, founder of the MIT Media Lab, has developed the $100 laptop. Loaded with Skype (software enabling free international telephone calls through the Internet), the HDL (Hundred Dollar Laptop) will be distributed with the help of the United Nations to tens of millions of children in developing countries, free of any costs – http://abcnews.go.com/WNT/PersonOfWeek/story?id=1327028.
Children and their families in the poorest parts of the planet will now have an invaluable educational tool that will connect them to each other and to the rest of the world:

http://www.theregister.co.uk/2006/04/05/negroponte_defends_laptop/

Although having access to technology is the starting point, the key to student learning will lie in providing high quality, up-to-date professional training for teachers in using computer-supported technologies for effective student-centred learning.

**Special Learning Needs and Technology**

Consider the case of a university student who has injured her preferred hand severely, and her first day at university where she began to “teach” a computer equipped with voice recognition software how to recognise her speech so that she could learn how to “write” her assignments. Excruciatingly slow—one and a half hours’ of dictation and correction to produce an accurate paragraph—it was nonetheless miraculous to see what would otherwise have been a tragedy turned into a situation where a young person will have a chance, albeit a slower one, to learn and achieve success.

Much research has shown that computer-assisted instruction can raise the academic achievement of students with mild and moderate learning disabilities in mathematics, spelling, reading and other subject areas. There are many additional ways, however, in which computer-based technology can help overcome educational disadvantages for students with special learning needs. Computer-based assistive devices for learners who cannot speak or write, for example, can provide an enormous range of communication possibilities.

Individuals with special needs can learn so much more through assistive technologies such as “switches” that interface with keyboards that can be activated by a blink, joystick alternatives to a mouse, speech-to-text and text-to-speech software, and Braille converters.

Visually impaired students can access information from computers linked to speech synthesisers and Braille printers, use speech output devices that can “explain” what a computer program does, or “read” with their hands vibrating tactile displays that have been converted from a printed page. In this context, see the **JAWS (Job Access With Speech)** site to learn more about the capabilities of this amazing screen reader (text on screen is read out loud from to the visually impaired user or converted to Braille) - http://www.nanopac.com/JAWS.htm.
Don Johnson’s Write:Outloud SOLO is a talking word processor that can be used to motivate any users who have difficulty with writing, not only those with specific disabilities - [http://www.spectronicsinoz.com/product.asp?product=18688](http://www.spectronicsinoz.com/product.asp?product=18688).

Produced by the same company, the NoteTaker (Portable Electronic Highlighter) is another tool that can be of great assistance for those who have difficulty in reading and comprehending written text. It enables the user to quickly highlight and scan printed text to later re-read and study using the auditory feedback of a speech-supported application (such as Read:Outloud). Students can also use such an electronic highlighter to do research and collect information for written assignments, which can be uploaded to Draft:Builder where further structured assistance is provided for moving from an initial outline of their ideas to the final written product - [http://www.spectronicsinoz.com/product.asp?product=19381](http://www.spectronicsinoz.com/product.asp?product=19381).


**A Final Word**

At the risk of stating the obvious, the onus is on the professional to diagnose students’ individual learning needs and to accommodate these through a range of instructional strategies and tools. This will undoubtedly be a very laborious and intensive responsibility to select carefully, review thoroughly and monitor fastidiously any educational hardware and software that is used—there are no short cuts to effective instruction for any learner. In this context, it would be worth looking at Chapter 11 where we consider the many special needs of learners and the teaching implications of these.
**QUESTION POINT**

You want to purchase two types of educational software for your school: the first is to help develop the various abilities of the intellectually gifted; the second is for some students to develop greater creativity or extend their talents in one area. Write a proposal in which you explain why you want these tools and then prepare a counter-argument against their purchase on the philosophical ground that “all students are gifted”.

**QUESTION POINT**

Debate the advantages and disadvantages of making laptops compulsory within different educational settings. Consider the relative perspectives of parents, students and educators, as well as keeping in mind the age of the learners.

**QUESTION POINT**

The Parents’ Association at the school in which you work as the ICT coordinator has just voted to direct all fundraising efforts for the next two years towards yard renovation and beautification (removing asphalt, planting trees for shade and environmental reasons, etc.). The staff have a strong desire to update the computer equipment and networking, however. They need the financial support of the energetic Parents’ Association. What will you do to make a strong case for the learning benefits of improved access to ICT and connectivity between learners, teachers and parents?
ACTION STATION

Investigate the types of commercial software that you could readily purchase for students with mild learning disabilities in a mainstream educational setting. Write a review about two examples of software for such students. Explain why you would choose these; how you would diagnose what the students’ needs were relative to the content of the program; and how you would assess any progress made. Think about whether the students would use the programs individually, with a peer (at what level of ability?), with an adult (parent helper or aide), or you, the instructor. What would your rationale be?

ACTION STATION

1. As an aspiring educator you should be aware of what is available commercially in the area of computer hardware and software. Find out the answers to the following and share these with your group.
   - What can the latest computer systems do that would make your own learning and your role as an educator easier in terms of preparation and presentation of learning activities, daily teaching tasks, record keeping and assessment/evaluation?
   - What types of software are available for learners at various ages? Note down those that are designed to foster student learning, those that are for entertainment, and those that purport to be for “edutainment”. What about the range of applications that are available, such as spreadsheets, databases, word processors, simulations and creativity and productivity tools? Which of these might have a place in your educational setting? For what purposes?
   - Who are reputable commercial educational software suppliers? Familiarise yourself with the range of software available from these suppliers and ask for a free demonstration of something that really interests you. Present an information workshop to the rest of your class.
   - What quality educational materials are available to be downloaded free from the Internet, for example: [http://www.freewarehome.com](http://www.freewarehome.com)? Share these “finds” with your group members. Teachers Report Assistant is an example of free software that will make
writing student reports quick and professional -
Free Electronic Books are available at the Classic Bookshelf site which allows the reader can modify the screen display of the text to suit their personal preferences – such as colour, font style and size, and justification of text -

Project Gutenberg of Australia also provides access to free electronic books that are in the public domain - http://gutenberg.net.au/.

2. Imagine that you have only one computer with Internet access in the remote learning setting in which you expect to teach children in what is called a “composite”, “family” or multi-aged class of 16 learners, aged from 9 to 15 years. You have begun programming a series of learning activities for the first term. Devise a range of ways (for both individual and cooperative group use) in which you might incorporate the computer in order to enrich these activities for your learners.

3. Now image that your four older learners will each have a Personal Digital Assistant (PDA) to use in the learning setting. How will you exploit their availability in a creative way?
Recommended reading

Elliott, A. (2004) When the learners know more than the teachers.  
http://www.infoage.idg.com.au/index.php/id;667259628;fp;4;fpid;404956636


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