CHAPTER 2
THE CURRICULUM AND
THE LEARNER

Just as computer technology has proved a powerful tool in re-engineering many areas of human endeavour, it has the potential to transform the processes of learning and teaching. Moreover, as information-rich technology diffuses pervasively into homes and workplaces, it increasingly calls into question the relevance of much within traditional knowledge-based curricula. In a world with easy access to huge stores of information, the skills of accessing, handling and using data and materials become more important than the ability to recall in detail ever greater amounts across many fields of knowledge. The young people who inhabit this technology-rich information society already question the relevance of the traditional approach. Aspects of existing school practice are called into question, as ICT both underlines a need for curriculum change and affords the means whereby the desired change can be achieved.

ICT can provide a resource-rich environment and a learner-centred approach that together alter the teaching-learning relationship by significant dimensions. It supports different ways of learning, thinking and working across the curriculum, that enable diverse, creative and engaging forms of participation. School learners have already begun to anticipate the enormous gains, and to see the necessity for ICT skills, the tools they know they must have as adults in tomorrow’s economy.
and society. The point was well grasped by a participant in the International Student Network:

You can more easily find a job after graduating, if you are well skilled for the requirements of today’s world. For example, my region had been a coal-mining area for a long time, but now there is much unemployment because of pit closures. To enable people there to get other jobs a special computer centre has been created in my city (…). People learn there how to operate computers and use the Internet – everything that ICT can offer in today’s world. Many have already found new jobs thanks to that and unemployment has decreased immensely (…). It is the same with young graduates: many are unemployed but would get a job if they had better ICT skills.

Participant in OECD International Student Network

**Policy approaches towards ICT in the curriculum**

In recognition of its profound and underlying importance, many governments have adopted large programmes to introduce ICT into the school curriculum. Thus, in April 1999, the Australian State/Territory and Commonwealth Ministers of Education identified familiarity and competence with ICT as one of the central goals of education for the 21st century. Students leaving school are to understand the impact of ICT on society and be “confident, creative and productive users” (Australia, 2000a). Other objectives stated in the same declaration are readily attainable through ICT, including: capacity for, and skills in, analysis and problem solving; ability to communicate ideas and to collaborate with others; employment-related skills and positive attitudes towards lifelong learning. Overall, the aim is that schooling should develop fully the talents and capacities of all students.

The US government has a range of educational policies for ICT use in the 21st century, in recognition that it “offers students experiences available nowhere else”.1 The benefits identified – including computer-generated simulations – arise from using videodiscs, the Internet, and CD-ROM. Students are seen to learn problem-solving skills better than by traditional methods; they become competent in organising complex information, recognising patterns, drawing inferences and communicating findings. With similar awareness, the European Union has

---

embarked on the *eEurope 2002* plan, which will seek to ensure that all students are digitally literate by the time they leave school. In June 2000 the European Council requested (the Lisbon Declaration) that:

- Every citizen be equipped with the skills needed to live and work in the new information society.
- Member states ensure that all schools in the Union have access to the Internet and multimedia resources by the end of 2001.
- Member states ensure that all the teachers needed are skilled in the use of the Internet and multimedia resources by the end of 2002.
- Schools are progressively linked to the very high-speed trans-European network for electronic scientific communications to be created by the end of 2001.
- Europe’s education and training systems must adapt to the knowledge society.

A variety of arrangements is now in place across OECD countries to promote ICT in schools. Often the new technologies first entered the curriculum within certain subjects, such as mathematics and physics, *e.g.* Portugal (country note), humanities, *e.g.* Canada (country note), and particularly in areas that quickly established a strong affinity with ICT, notably design technology and business studies. France began educational use of ICT with the scientific subjects – using measuring devices and spread sheets – and with language laboratories, but in line with national curriculum development, use is now growing across all subjects at all levels (country note). In the Netherlands, ICT is introduced as a subject in its own right – Dutch students learn the basics in *Information and Computer Literacy* – and then used in various other subjects (country note). A *cross-curricular* usage was adopted in the Belgian Flemish Community (country note), where minimum competencies in the use of ICT are specified by attainment targets.

Several OECD countries have defined levels of ICT usage, focussed usually on the skills of information handling and the higher-order thinking skills. The UK national curriculum has a requirement that all students be given opportunities to apply and develop their ICT capability, through the use of ICT tools to support their learning in all subjects (with the exception of physical education in the early stages). They are to use ICT to extend and refine their ideas, selecting and synthesising information from a variety of sources, with an eye to its reliability; they are to communicate electronically and reflect critically on their work as it develops (UK, country note). Even though a country may have no formal
curriculum requirement, there is an increasing tendency for schools to include ICT within the teaching programme.

In addition to basic provision for all, ICT may be an optional subject for older students wishing to specialise, as in Canada (country note) and Denmark (country note). Education systems are not homogenous, and there are differences within systems as well as between them. Luxembourg, for instance, has ICT treated differently in different types of schools. However, the general trend is towards cross-curricular adoption of ICT, supported by studies indicating significant learning gains associated with its use. In the UK it is reported that primary schools with good ICT resources have achieved more by the end of primary education than others; the great majority (86%) of head teachers in the better-equipped schools believe ICT to have been important in raising standards (BECTA, 2001).

As with curriculum issues more generally, there may be problems in securing continuity with ICT across the different phases of education, notably the transition from primary to secondary. Increasingly, however, basic ICT capability will be acquired at the primary level and available for use and development thereafter.

- Many governments have adopted major programmes to promote the use of ICT across all aspects of school life. This is in response to its pervasiveness in economic and social life, and to profit from its potential to improve the quality of learning through the development of higher-order competencies. It still needs to be asked how far the realities of educational practices match the ambitious official aims.
- The intensive use of ICT in education often began in specific subject areas, including informatics – and which areas differed to some extent across countries – but the general trend is now towards adoption of ICT across all parts of the curriculum.
- ICT integration across the curriculum is not incompatible with informatics as an option for some, and supplementary occasional courses on digital literacy for all.

**ICT BRINGS NEW DEPTHS TO LEARNING**

The students in the International Student Network can be very perceptive in commenting on their own learning experiences involving ICT. They often give us salutary reminders of the realities behind the laudable aspirations, and
have a keen awareness of why some learning situations are successful and others not. In the experience of the student users of ICT, tools – word processing, spreadsheet and graphics – were used across most subjects, along with CD-ROMs for a variety of purposes, whether subject-specific or encyclopaedic. Whatever the subject area, the small physical size and large capacity of CD-ROMs make them very appealing to students:

CD-ROMs are easily portable, which allows students to carry numerous CDs with them during the school day, whereas if they had to carry books their load would be considerably heavier. Because CD-ROMs hold a large quantity of information, they are more convenient than books. Any written texts may run to several editions or volumes, making it time consuming and tedious when trying to find relevant information.

Participant in OECD International Student Network

Interactive encyclopaedias were generally seen as effective in class, and user-friendly, even for those with little ICT experience. They allowed the student to explore without the need for constant intervention by the teacher. A recurring criticism, however, was the lack of depth in the presentation, and from an international perspective, the inequitable treatment of different world regions. An encyclopaedia would offer more information about the United States and certain European countries than the rest of the world. In particular, information about African countries was limited to brief summaries and chronologies. One student was shrewd enough to observe that the depth of treatment is no doubt related to the potential customer base in the countries concerned.

What are the advantages of CD-ROMs for learning in the different curriculum areas, as seen by the students? The illustrations which follow are drawn from particular subjects of study but are not unique to them. Students welcomed the greater reality brought to history, by seeing press cuttings, film of important national events including speeches, animated simulations of marches and wars, or visits to archaeological sites. A disc is compact, and yet affords a cornucopia of well-presented information, for instance concerning an earlier civilisation’s social, political and economic organisation as well as aspects of its culture, art and religion. It makes an enjoyable way to study and to learn, or – as one student conceded – a way that is not so boring. In geography, the multimedia approach with a world atlas was seen to give a better understanding of
political situations. Because of clear explanations of technical terms on a CD-ROM, the teacher has to spend less attention to defining them for students, thus making needed time available for other priorities.

In science and mathematics, students saw advantage in illustrating basic physical concepts by animation, and doing virtual experiments to explore the laws of motion. It does not displace the need for actual laboratory work, but adds a fascination, and makes for a pleasant classroom environment in which students help each other. Because software can solve algebraic functions fast and accurately, students said they were freer to focus on understanding of concepts rather than on repetitive calculations. Pictorial presentations make such functions more easily grasped. Mathematical modelling can be used in biology to show how populations change over time according to different starting parameters, while simulations and videos can show how the human body works, how a cell functions, and how oxygen is transported.

The use of CD-ROMs can lead to exemplary learning sequences, but this is by no means necessarily the case. In a reported biology class, the available CD-ROM was found to be difficult to use and unclear in its presentation. The teacher struggled with it, but eventually the class went back to more traditional methods. Students sometimes found inadequate guidance as to which disc to choose from those on offer, many being inappropriate. In one school, of the 50 titles notionally available, only 8 could be accessed. There were problems, too, over inadequate numbers of computers, making it difficult to book one in the time available to a student or a class.

Software is seen to be powerful, but not invariably user-friendly. Students can be left to their own devices, with inadequate preparation, and so take an inordinate amount of time to learn to use it. An example given was the learning sequences within software designed to improve typing skills, at times too easy but becoming too demanding. Because teacher intervention was required to guide through the sequences, little time was left to help those in specific need, and the motivation of many in the class was lost. In another reported case, problems arose in relation to programmable calculators: those with previous experience finished their tasks in a short time, but the teacher had no time to instruct others in the basic concepts without which they were unable to proceed.

The use of ICT in education can encompass a range of approaches effectively. At a relatively straightforward level, when a CD-ROM provides an alternative to conventional encyclopaedias, the gain is in convenience, effectiveness and
CHAPTER 2. THE CURRICULUM AND THE LEARNER

attractiveness rather than any radical change in learning methodology, as illustrated by the following student quotation:

In school we frequently used interactive encyclopaedias (...) [that] thanks to an index allowed rapid access to the desired information. They were mostly very comprehensive, and provided another perspective on the classroom treatment. The links between articles helped us to pursue the subject in greater depth. Furthermore, the multimedia support (animations, images, etc.) made learning more enjoyable. The possibility of printing individual articles made it far easier to carry than having to take with you a heavy traditional encyclopaedia.

Participant in OECD International Student Network

More radical would be an integrated learning system designed to replace the teacher – at least in part – for the development of a course unit. In mathematics, for instance, this could be mastery of the techniques of long division, where the approach might offer a more effective alternative to traditional written exercises. As students work through problems, benefit arises from the instant feedback, intended to prevent errors or misconceptions being reinforced. Even further from traditional approaches would be a student holding a videoconference with a fellow student in a foreign country to discuss global warming, through which they each develop their language skills and mutual understanding. This goes well beyond the traditional boundaries in promoting autonomous learning. These varied approaches serve quite different purposes, involve different methodologies, and are likely to suit different curricula.

- ICT-based learning materials vary considerably in subject coverage, suitability of learning sequences and user-friendliness, but at their best are well-liked and valued by students.
- When ICT simply offers an alternative delivery medium (such as putting an encyclopaedia on CD-ROM), the gain to the learner is in convenience, speed, capacity, motivation and attractiveness.
- ICT can serve quite different educational purposes and methodologies, some of which extend well beyond the traditional curriculum. Used wisely it enhances knowledge, language and communication skills, collaborative learning, understanding and respect for others.
STUDENT-CENTRED LEARNING

There is wide acceptance among many educators that individual learners construct their own understanding, by building on previous experience. According to this approach (sometimes described as “constructivism”), understanding arises as learners through prolonged engagement relate new ideas and explanations to their own prior beliefs. It implies that working with concrete problems develops the capacity for deciding how and when to use existing skills. Personal knowledge building in this way forms a useful model across the curriculum, implying that an appropriate learning programme is likely to include projects, group work, problem solving, reflective writing and other tasks that stimulate meaningful thinking (adapted from Ravitz et al., 2000).

This learning model is highly relevant in an ICT-rich environment, in relation both to increasing understanding, and supporting the development of thinking skills. The particular facility of some forms of ICT is to provide a more open environment that promotes autonomous learning; it affords an opportunity to be grasped, with teacher guidance and support. Teachers will work collaboratively with their colleagues to share expertise, focusing on the activities and needs of individual students and small groups. Much classroom work has been developed using content-free software, such as word-processors, spreadsheets, Web-authoring tools and presentation packages, which form the basis for creative cross-curricular activity. Student engagement is enhanced where the computer is integrated in this way, and where teachers are willing to break down disciplinary and unit boundaries (Sandholz et al., 1997).

The Mönsterås High School development is an example of an innovative school in Sweden using a high level of ICT to support problem-based learning within the national curriculum (Dennersten, 1999a). The teacher no longer teaches the students directly, but creates an environment for successful learning, and acts as a source of inspiration and support. Key elements in the method include defining a problem, searching for information and evaluating it, reporting the results and drawing conclusions. Students choose their projects and engage in their own research, which extends to independent work outside school. All teachers and students at Mönsterås High School have been given their own portable Macintosh computer, equipped with Claris Works, e-mail and a Web browser. The school has a local network, an Internet server and a mail server, to which all classrooms, group-rooms, the teachers’ room and even certain activity rooms are connected. The project approach has encouraged cross-curricular work,
for example history and language teachers working together. Teachers and students are very positive about the scheme. Parental enthusiasm is so strong that private schools are beginning to adopt the same approach.

Another example is the Methodist Ladies College in Melbourne, Australia, which provided each Year 7 student with a personal computer (McFarlane, 1997, p. 174). The college wanted to adopt a different learning style that could be supported by ICT, in pursuit of which the formal structure of 40-minute lessons was abandoned. The students became more pro-active in their learning, without the loss in social and creative experience that some had supposed inevitable. The working tasks expanded beyond traditional subject boundaries, as when “some children began to use French in a mathematics context – the first time the French teacher had ever known children to use French voluntarily outside a French lesson”. Teachers became consultants within the learning environment and were no longer controllers of it.

Schools engaged with ICT can experience more than one type of benefit for learners. In the SITES study (Pelgrum and Anderson, 1999, p. 223), schools using ICT reported gains in knowledge and skills, motivation, responsibility and independence. Such gains are well illustrated from a UK primary school:

Year 6 students in a Lancashire primary school visited a residential centre in mid-Wales in the Autumn term. The main objective was to carry out a comparative study of the weathering of different types of rock, using the gravestones in the nearby cemetery and in the graveyard back home. They entered information about the types and age of the stones used, and graded each entry according to how weathered it looked. Subsequently this information was transferred to a spreadsheet and plotted as graphs and charts for comparison with local headstones. Whilst collecting data on the field trip some students noticed the predominance of certain family names on the headstones. This led to a discussion about how to organise databases in order to facilitate searching and sorting. This project went on to involve an exploration of the impact of industrial pollution (by communicating with students in other regions) and an analysis of the age at death, which led to an exploration of social history.

From the NCET Portables Pilot, UK, adapted from Stradling et al. (1994)

ICT can sustain differentiated activities for different learners within one classroom. A teacher may use software to provide challenging activities for groups of learners, thereby freeing time to work on a more individual basis with other
students. It brings media richness, both in learning materials and in the creative work produced by the students themselves. The value of this goes beyond multimedia learning, and may help to accommodate differences in learning styles. Closed applications, such as didactic software that rehearses basic skills, may have a certain usefulness for all learners on occasions. They have proved especially useful in engaging less-able learners, in part because the computer is seen as impartial and able to give feedback on errors without the negative associations of teacher criticism.

Significant benefits have been derived from the use of ICT by students with special needs. While this cannot be analysed in any depth here, it is important to note that in certain countries special schools were among the early adopters of the new technologies. ICT has allowed children with visual and muscular difficulties to read, write and express themselves. In some cases the technology has allowed children with special needs to attend ordinary schools. Canada has seen benefits for students with intellectual and learning disabilities, those with visual and hearing impairments, and those for whom English is a second language; gifted students also have benefited (Council of Ministers of Education, Canada, 1999).

- The notion of constructivism – individuals developing understanding, through building on previous experience – is widely acknowledged. It favours the use of projects, group work, problem solving, reflective writing and other tasks that stimulate thinking, all of which can be sustained by ICT.
- Student engagement is often enhanced in an ICT-rich environment, with appropriate teacher guidance and support.
- In certain countries, special education was the lead educational sector in exploiting ICT, with major benefits for students with special needs. The ability of ICT to support autonomous learning is advantageous to all and provides an opportunity to be grasped.

**STUDENT ASSESSMENT**

The changes which ICT can bring to education are profound, but what are the implications for the assessment of student performance and certification? Voogt and Odenthal (1999) have proposed a series of emergent practices associated with the integration of ICT in education, which imply and invite radical change. They see an emphasis on skill development and on cross-disciplinary activity more in keeping with real life, developed and accredited through formative and
summative student assessment by a variety of means, including portfolios. Students will themselves accept more responsibility for their own learning and its assessment, developing expertise in the process.

As learning objectives and procedures relating to the use of ICT become an increasingly important part of the curriculum, this should be reflected in the assessment procedures. Testing of basic ICT capability – such as the ability to use spreadsheets in simple ways – may be demonstrated by a variety of means across the curriculum, or by practical exercises designed for the purpose. It may, however, be difficult to assess the more sophisticated levels of ICT skills and processes, except through realistic activities in which they can be displayed. Further research into appropriate techniques is needed here, but there is a principle to be followed. In so far as ICT is seen as a pervasive influence and working medium throughout the curriculum, its presence must be reflected in the assessment procedures to the same extent.

To illustrate, where word processors are used in schools under existing curricula and examination systems, they are rarely used in an iterative way. Beyond the correction of spelling and grammar, the text created usually remains undeveloped. The work created digitally is usually left at what in other walks of life would be described as a “first draft stage”, and it is this – and no more – that is used to assess the student’s understanding and knowledge (McFarlane, 1997). Opportunities for formative assessment through the process of drafting, editing and re-drafting are lost, and the higher-order objectives made possible by word-processing and multimedia are left unattended, as though unimportant (McFarlane et al., 2000). The need for coherence between curricular objectives and assessment procedures is illustrated from New Zealand:

Despite this broad agreement, some of the official curriculum documents present a confused message. The New Zealand curriculum statements for mathematics and science contain teaching ideas that suggest a constructivist approach. Yet the framework of the documents, with eight hierarchical levels of achievement objectives closely related to assessment, suggests a reductionist, behaviourist view of learning. The two very different and competing views on learning are mixed within the documents, and there is no clear indication of how the inconsistency should be resolved.

New Zealand (2000)
Unless assessment procedures faithfully reflect the levels to which ICT influences curriculum delivery and associated learning outcomes, they will lack validity. In consequence, the benign influence of ICT across the curriculum will be severely constrained. US examination candidates who are active computer users appear consistently to under-perform in paper-based tests (Russell and Haney, 2000). Teachers preparing their students for conventional examinations will feel obliged to avoid such risks, and modify their programmes accordingly. The nature of any assessment system has an influence on the curriculum, and has a powerful role in defining the real – as distinct from the intended – curriculum.

Secondary schools in Ireland – and no doubt in other countries – have a major emphasis on formalised assessment that leads to “a tendency to narrow the curriculum and force teachers and students to focus on examination results” (Morrissey, 1999). Nevertheless, a pilot project allows students of the Leaving Certificate Vocational Programme to submit a multimedia product generated in Hyperstudio as part of a portfolio for assessment, an option that appears to be attractive to many students (NCTE, 1999). Similarly, in Sweden, a very flexible approach allows schools much freedom to establish their own assessment procedures (Dennersten, 1999b).

Several countries are experimenting with the expanded use of ICT-based examining. An area of interest is the use of ICT-based project work as a significant component of formative and terminal assessment, including individual students building their own electronic portfolios throughout each phase of education. This is one means for at least an element of the assessment to be compatible with an open and exploratory curriculum. In some Canadian jurisdictions, students may now take their grade 12 examinations using computers and graphing calculators, and on-line testing is under scrutiny. In France the new concept of travaux personnels encadrés (a teacher-managed record of personal achievement) will offer frequent opportunities for ICT usage.

Assessment of digital content does present challenges, which has made some resistant to change. The ease with which digital material can be copied and modified raises the issue of widespread plagiarism, although anti-plagiarism software is emerging.² There is the risk that an assignment might be judged more for its technical competence than its content, as when a student’s ability to create a page with sound might lead the teacher to overlook the trivial or irrelevant sound chosen (McFarlane and de Rijke, 1999). If several students have

collaborated on a project – as is often desirable – it may be difficult to discriminate between individual contributions. Such issues notwithstanding, “the assessment frameworks must change to recognise skill-related attainment more highly”, in order to promote the curriculum reform needed for ICT to be fully integrated (McFarlane, 2001).

The pervasive adoption of ICT in education both requires different assessment procedures and provides a variety of means. Within the learning process, ICT testing techniques can offer rapid formative assessment and feedback, to encourage motivation and stimulate self-directed learning. For certain purposes objective testing will be useful, especially if followed up by on-screen discussion of the options offered, with ultimate recourse to the teacher when necessary. Although the value of formative assessment has long been acknowledged, it has not commonly been undertaken on a useful scale, being very demanding of teacher time. ICT brings new possibilities for this deficiency to be remedied.

Teachers recognise that one of the great advantages of this technology is that it gives students immediate feedback on their progress. It allows students to test themselves, checking to see if they have mastered a new skill, or have the knowledge required to move on to other work. Such techniques teach students that they have the capacity to improve. Immediate feedback can motivate students who might otherwise have very little interest in school. Students who get into the habit of checking their own learning are self-assessing, an important skill at a time when more and more people are required to consider how well prepared they are for jobs. As students take greater responsibility for assessing themselves, the pace of learning changes and becomes more individualised. All of this is altering the way schools and learning are organised.

Canada (country note)

What is assessed in schools and how the assessment is performed exercises a very powerful influence on the curriculum. The potential of ICT will not be realised as long as assessment is primarily in terms of student achievement in single subjects, by means of conventional written tests.

Progress in this direction has been disappointing, acting as a brake on the imaginative use of ICT. The promotion of advanced skills and competencies will fall short in assessment regimes that are overwhelmingly knowledge-based.
The pervasive adoption of ICT not only requires different assessment procedures but provides a variety of means to meet this need. Several countries are experimenting with ICT-based examining, including electronic portfolios.

The value of formative assessment – regular informal updating of student progress and difficulties – is often acknowledged but little practised. ICT offers promising avenues for rapid formative assessments and feedback, to refine learning and teaching strategies.

ICT DRIVING AND FACILITATING CHANGE

Curricula can be characterised as a spectrum ranging from open to closed. The closed (traditional) model presents a closely-defined set of content and rules which students are required to learn and reproduce. For this model, courseware and information sources are seen as most relevant when they follow the prescribed curriculum. Curricula may have been modified to incorporate ICT, but where this is limited to basic operational skills little additional intellectual challenge is involved. Not all applications of ICT serve to promote higher-order thinking, and those which encourage rote learning – useful on occasions for revision or consolidation – will not expand the scope for independent thought. We have seen compelling examples of the radical transformations brought about by ICT, but simply to say that computers are being used in school does not, in itself, necessarily imply any particular change in teaching style.

Schools seemingly find it extremely difficult to actually integrate ICT into the teaching process (...). Some 90% of primary school teachers do use the computer during lessons, but what that actually means is individual use by pupils, for example those who are lagging behind, or pupils who quickly finish other assignments. At secondary schools, a third of teachers use computers during their lessons, in particular for such subjects as information science, vocationally-oriented subjects and mathematics (...). It is still proving difficult to integrate ICT into school activities and to make innovative use of it.

Netherlands (2001a)

Why should it be proving difficult to integrate ICT? The closed curriculum cannot easily embrace the radical change that ICT invites, indeed requires. With a more open curriculum model, where the content is less prescribed, it is possible
CHAPTER 2. THE CURRICULUM AND THE LEARNER

to focus on the skills needed to build and communicate knowledge. Here
communication applications, creative frameworks and information sources all
have a potential role. In Sweden, where ICT is integrated across the curriculum,
and teaching has become more individualised, the curriculum has moved in
this direction:

The former Swedish system was characterised by very detailed curricula and
syllabuses. Each subject was divided into modules with instructions from a
national authority on what should be taught in each module, how long it
should take, and sometimes also the teaching methods to be used. It was also
stated when during the term each module should be finished (...). The present
Swedish system represents the opposite approach. We now have goal-oriented
curricula and syllabuses. Now the syllabuses specify the targets that teaching in
different subjects should aim at, and the targets students should have achieved
after the fifth and ninth year in school.

Hylén (1999)

The more open range of activities afforded by ICT is well exemplified
by its potential to develop writing skills. Even at its most basic, writing with
a word processor rather than on paper is better motivating to some. Motivation
may also come from the potential to create “professional-looking” documents,
where the final product is of high quality even for learners with poor
handwriting. Further gains can be achieved through the use of on-line
technology to facilitate more authentic and engaging tasks, such as writing
to learners in another school or country, or working collaboratively on
substantial projects. On-line activities such as this gain in credibility and
authenticity, since their purpose and outcomes extend well beyond the actual
writing of text.

But there is more. The word processor offers the ability to easily modify,
correct and re-structure documents. Text becomes a mutable entity, to be
revisited, extended and revised so that it reflects a growing understanding, a
growing personal knowledge. In addition, there is increasing use of non-linear
forms of writing using hypertext systems, and of multimedia, as pictures, sound
and video are integrated into texts. Such freedom to decide how topics or ideas
should be presented, according to perceived relationships, is likely to make the
processes of categorical thinking and analysis more explicit to students
(McFarlane et al., 2000).
As many students are at a stage of their cognitive development when their written expression is not sufficiently sophisticated to describe complex networks of associated ideas, multimedia authoring may encourage self-directed learning and genuine self-expression (Bonnett et al., 1999). It offers the possibility of realising structure in a manner that reflects the thinking process itself and the organisation of human memory. The very processes of producing multimedia “texts” are likely to assist the accomplishment of conceptual and procedural activities, such as the definition of relationships, consideration of the appropriateness of information for different readers, and the use of argument to establish or review different positions.

The writing skills example illustrates the enormous potential of ICT to expand the learning experience, a potential largely untapped when ICT is merely used to do traditional things in a different way. There is, however, considerable tension between traditional curricula and a more open, skills-based approach. Even where new skills are incorporated in a curriculum, there will not be the time to develop them effectively unless there is a corresponding reduction in the amount of factual detail prescribed. The tension will be especially evident where conventional assessment and certification procedures, or back-to-basics emphases, are sustaining traditional aspirations. This very tension can be turned to advantage, however, as ICT becomes both the driver and the facilitator of radical change across the curriculum. Canada provides an example:

Many educators see the new information technology as a catalyst for a revolution in the classroom, since it requires new approaches to learning and teaching if its full potential as a learning resource is to be realised. Further, information technology promotes a restructuring of the curriculum for elementary and secondary schools, with a renewed focus on the skills of accessing, managing, and processing information, collaborative working skills, problem-solving, and learning to learn.

Canada (country note)

- The closed, traditional curriculum, based on well-defined content and rules which students must learn and reproduce, stands in the way of ICT integration. Powerful tensions exist between traditional curricula and the more open, skills-based approaches supported by ICT.
CHAPTER 2. THE CURRICULUM AND THE LEARNER

In more open curricula with less prescription, there is greater room to focus on the skills needed to build and communicate knowledge. As ICT gains acceptance in schools, it may become both the driver and the facilitator of such radical change.

Greater use of ICT and the development of students’ writing may powerfully reinforce each other rather than be in conflict. The technical scope of word processing can facilitate more engaging tasks and be highly motivating.

DIGITAL LITERACY – AN EDUCATIONAL POLICY IMPERATIVE

A parallel has emerged between the concept of literacy and the sophisticated processes and activities that ICT has made possible across the knowledge domain, encapsulated in the notion of digital literacy.

Societies consider high levels of literacy to be desirable for all of their members to sustain widespread participation in economic, social, cultural and political life. Literacy is important for communication and making informed decisions. It is a necessary ingredient for citizenship, community participation and a sense of belonging. Literacy is also a tool for efficient learning, particularly self-directed learning of the sort that is enabled by information and communication technologies.

OECD (2000a), p. 83

Just as “conventional” literacy is more than basic ability to read a sequence of words, digital literacy is more than ability to use a computer in simple ways. Acquisition of basic ICT skills is important, but no more than an initial element, since change is rapid, and simply learning to operate existing technology will be of limited usefulness. The need is to understand the potential of the technology, and to acquire confidence and skill in adopting it for appropriate applications. This means being a critical and discriminating, as well as confident, ICT user.

At the OECD roundtable that concluded the work of the International Student Network,3 the analogy was drawn with driving a car. It is one thing to know the rudiments of gear-changing and so forth, but quite another to navigate purposefully, to have a sense of direction and strategy. Digital literacy embraces

a sophisticated skill set that has revolutionised the workplace and community life, and is increasingly required for full engagement in society.

Some earmarked time and courses might need to be devoted to digital literacy within the school programme. Individual subjects might not easily find the time, for instance, to go into the protocols of Web page production, advanced Internet search, or working with multimedia. Each subject would benefit, however, from the availability of such expertise, to be integrated within the learning activities they offer. The richness of the learning environment would thereby be enhanced and further support given to the foundations for lifelong learning.

ICT use enriches the school curriculum in at least two fundamental ways. The first is as an enhancement across almost every subject and activity, through resource banks, simulations, learning sequences, collaborative activity and so forth. This in itself has the potential to transform the learning environment more than any innovation hitherto. The second, and yet more radical, is the pursuit of digital literacy in its own right, whereby the individual becomes empowered as a discriminating and autonomous learner.

- **ICT** integrated across school subjects and activities has the potential to transform and enrich the learning environment more than any innovation hitherto.

- Digital literacy refers to a sophisticated set of competencies pervading workplace, community and social life. Individuals need to understand the potential of the technology, and to become confident and competent, critical and discriminating in using it.

- There may well be advantage in devoting occasional supplementary school programmes to digital literacy, in addition to the cross-curricular use of ICT, to enhance skills and strengthen the foundations for lifelong learning.