NATIONAL COUNCIL FOR CURRICULUM AND ASSESSMENT

CURRICULUM ASSESSMENT AND ICT IN

THE IRISH CONTEXT: A DISCUSSION PAPER

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1. Introduction

Curriculum, Assessment and ICT in the Irish context: A discussion paper sets forth a vision for Information and Communications Technology (ICT) in curriculum and assessment in Irish Primary and post-primary schools. This document has been developed to enliven and enlighten current discussions and deliberations regarding the potential of ICT to support and extend the curriculum development work of the National Council for Curriculum and Assessment (NCCA). In so doing, this discussion paper will provide direction to the NCCA's work programme for ICT in curriculum and assessment.

The audience for this paper includes all those with a responsibility for, and an interest in, ICT in education including teachers, parents, school support staff, policy makers, and many others.

Throughout this discussion paper the term ICT is used to cover a range of tools and equipment. ICT includes the hardware and software devices and programmes that allow people to access, retrieve, store, organise, manipulate, and present information by electronic means (such as personal computers, assistive technology, scanners, digital cameras, multimedia programmes, image editing software, database and spreadsheet programmes). It also includes the communications equipment through which people seek and access information (including the Internet, video conferencing, and the range of assistive technologies).

In as much as these tools and equipment collectively referred to as ICT, have the potential to significantly effect the curriculum and assessment processes and practices in schools, they are of relevance to the NCCA. The NCCA's role in curriculum and assessment is clearly outlined within the Education Act (1998), which states that the NCCA shall advise the Minister on matters relating to

- *the curriculum for early childhood education, primary and post-primary schools, and*
- *the assessment procedures employed in schools and examinations on subjects which are part of the curriculum*

(Section 41, Subsection 1)

Additional clauses in the Education Act ascribe further responsibility to the NCCA which include development and review of curriculum and assessment, curriculum provision for students with a disability or other special educational need, and advice on the in-service training needs of teachers. The NCCA's involvement in ICT in curriculum and assessment, while relatively recent, has been characterised by the organisation's remit, and marked by a number of milestones which are described below.

An ICT working group was formed in 1998, with the initial remit to examine issues regarding ICT in the Primary School Curriculum (1999) which was nearing completion at that time. This group recommended that the NCCA would develop ICT guidelines to augment teachers' and children's learning experiences with the Primary School Curriculum.

To provide further support for developing ICT guidelines, the ICT Steering Committee was formed in May 1998. The overarching responsibility of this committee was to examine issues identified by NCCA regarding ICT policy and provision in Primary and Post-primary

curriculum and assessment. The ICT Steering Committee proposed that the NCCA's work in ICT should be based on the following principles:

- ICT should be used actively by learners from junior infants onwards
- all learners should use ICT in relevant curriculum contexts
- by the end of compulsory education all students should have achieved a defined level of ICT competence.

A joint (Primary/Post-primary) ICT Technical Working Group was formed in 1999 to support the NCCA's work programme, guided by the aforementioned principles. A brief description of the main outputs and decisions from these groups follows

- A report by the University of Limerick, College of Education commissioned by the NCCA entitled *Computers and Curriculum- difficulties and dichotomies* was completed in 2001. This report explored the possible form and content of a computer-based subject and its potential impact on the established Leaving Certificate Programme.
- In June 2001, the NCCA adopted the proposal to focus its attention on two approaches to the use of ICT at Post-primary level:
  i) to support the development of student competence in using ICT
  ii) to support teachers'/students' use of ICT as a curriculum resource
- In November 2001, *Information and Communication Technologies in the classroom: the future role of the NCCA* was approved by Council and subsequently issued to the DES. This comprehensive document addressed the remit and work of NCCA in ICT to date, the requirement for a theoretical base underpinning the work, an outline programme for work at primary and post-primary and a discussion of relevant issues. This document also highlighted the need for dedicated Education Officers to pursue the ICT work programme in Primary and Post-primary curriculum and assessment.
- A draft document on the use of ICT in the Primary School Curriculum was launched in 2000, and piloted in 20 schools throughout the country with the support of the ICT Advisors in Education Centres nationally. The feedback and exemplars of practice generated through the project, informed the redrafting of the document. The revised document, *Information and Communications Technology in the Primary Curriculum: Guidelines for Teachers*, was approved by Council and was disseminated to schools in February 2004.

In addition to aligning theory and practice, by developing this discussion paper, the NCCA's current ICT work aims to further elaborate the potential of ICT to support teaching and learning across the curriculum and in specific subjects in primary and post-primary schools. This support will include identifying the kinds of knowledge, skills and attitudes that students can be enabled to develop through ICT key points in their primary and post-primary education. These experiences will be represented within a framework for ICT for primary and post-primary education.

Findings from the NCCA's reviews of the Primary School Curriculum, the Junior and Senior Cycle and the rolling review of subjects will continue to inform the NCCA's ICT work programme. These reviews will explore the potential of ICT to contribute to the educational experience of Ireland's young people. They will examine the extent to which ICT has been used to support existing and new teaching pedagogies, such as active and self directed

learning, to broaden the range of assessment methods, and to facilitate learning in a variety of learning environments.

Curriculum, Assessment and ICT in the Irish context: A discussion paper contains nine sections as follows

1. **Introduction**
   The introduction to the paper situates the NCCA's current work in ICT within the context of the NCCA's legislative remit.

2. **Overview of ICT in education**
   This section presents a number of rationales for ICT in education. European and Irish government policies vis-à-vis ICT are outlined and ICT initiatives in Irish education are discussed and analysed.

3. **Defining and Envisioning: ICT in Curriculum and Assessment**
   This section presents the NCCA's vision for ICT in Irish education in the knowledge society.

4. **Developing the vision: ICT in Curriculum**
   This section outlines how ICT can support the principle of learner-centred education. It describes a holistic approach to the integration of ICT in the curriculum and concludes with a series of snapshots highlighting how ICT adds value to the students' learning experiences.

5. **Developing the vision: ICT in Assessment**
   This section provides an overview of issues concerning the use of ICT for assessment of learning and assessment for learning.

6. **Building the NCCA work programme**
   This section describes the elements of the NCCA's proposed work programme in ICT in curriculum and assessment.

7. **Concluding Remarks**
   The concluding discussion focuses on key ideas highlighted within the discussion paper, and identifies some of the supporting strategies required to achieve the vision outlined here.

8. **References**

To further inform ICT developments in curriculum and assessment, the NCCA will continue to work closely with the ICT Policy Unit of the Department of Education and Science (DES), the National Centre for Technology in Education (NCTE) and the education partners through Council and its enabling structures. The NCCA currently convenes an ICT Steering Committee, which is a representative committee, responsible for directing the NCCA's work in ICT, Curriculum and Assessment.

2. Overview of ICT in Education

This section begins by identifying frequently cited arguments for promoting the inclusion of ICT in education. The 'rationales' provided for ICT in Irish and European policies are also examined and the outcomes and effects of Irish ICT policy to date are examined.

2.1 Frequently cited arguments for promoting ICT in Education

2.1.1 The knowledge society

In recent years, the pervasive influence of ICT has significantly increased our capacity, as a society, to generate, manipulate, store, and transmit large quantities of information cheaply[1] and to communicate with others almost instantaneously. This cultural trend is evident in the Irish public's increasing use of online banking, mobile telephony, ATM cards, online flight reservations, purchases, and the global transmission of digital files and images. Observers and proponents of this *knowledge society* suggest that our use of increasingly sophisticated and enabling technologies will continue, to the extent that technological literacy will become a basic functional requirement for our work, social and personal lives. They note that as the pace of technological development continues to grow, children in our schools today will live in a world where ICT will be increasingly embedded in their daily lives. Additionally, it is claimed that in this *knowledge (-based) society*, the most valuable asset is investment in intangible human and social capital, and that the key factors in economic and social development are knowledge and creativity.

European and international policies have explicated implications of the knowledge society for education. For example, the *eEurope 2002 Action Plan* has noted that curricula must adapt to meet the perceived needs of the knowledge society, given that traditional educational practices may no longer provide students with all the necessary skills for today's workplace. In the USA a number of bodies broadly representing cross-sectoral interests in education, technology, and business (the NCREL enGuage model[3], MILE[4]) have identified a set of '21st century skills', which incorporate an emphasis on learning skills, lifelong learning, adaptability, and the ability to think creatively and critically.

The OECD report, '*Learning to Change'* ICT in Schools (2001) incorporates a broad view of the knowledge society in outlining three primary rationales for the inclusion of ICT in education, namely:

> a *pedagogical rationale*
> The pedagogical rationale for the use of ICT in teaching and learning is based on the potential of ICT to increase the breadth and richness of children's learning
>
> *a social rationale*

[1] Information Society Commission (2002). *Building the knowledge society.*

[3] *EnGauge* was developed by North Central Regional Educational Laboratory (NCREL) and the Metiri Group, an independent consulting group specializing in technology in education.

[4] Partnership for 21st Century Skills, MILE Guide for 21st Century Skills, 1341 G Street, NW Suite 1100 Washington, DC 20005

The social rationale for planning for ICT use in classrooms focuses on the development of ICT competence, as an essential "life skill", in the same way as literacy and numeracy are currently viewed, thereby becoming both a requirement and a right.

an economic rationale
The economic rationale focuses on the potential of schools to prepare children to meet the perceived needs of the economy – present and future.[5]

The concerns of the OECD are echoed in Europe in a number of challenges for education systems. Among the challenges cited are:

- understanding the changing nature of what it means to be a responsible citizen
- educating children to be adaptable life long learners
- eliminating social exclusion
- developing workplace competencies
- developing the skills to maintain national competitiveness[6]

These priorities are also reflected in recent curriculum documents (Primary School Curriculum, Junior Cycle Areas of Experience, Senior Cycle Review) which promote the importance of higher order thinking skills, critical thinking, problem solving, collaboration with others, learning to learn, and the ability to adapt to change, etc., now proposed as key requirements of the knowledge society.

2.1.2 Benefits of ICT for teaching and learning

The potential benefits of ICT for teaching and learning are also touted as reasons for increasing our use of ICT in schools. Among the reported benefits are gains in student achievement, increased student motivation, improvements in students higher order thinking and problem solving abilities, and the development of students' abilities to work collaboratively.[7] Whilst research on the 'effects' of ICT on teaching and learning have provided mixed results, researchers have found that ICT can have a positive effect under certain circumstances, and for certain purposes. Longitudinal research studies, many of these carried out in the USA, have contributed to a greater understanding of how children learn using ICT. For example, the evaluation of the Apple Classrooms of Tomorrow project, (ACOT), an immersive ICT intervention, found that students used inquiry, collaborative, technological, and problem-solving skills far more than their peers who were regular graduates of traditional high school programmes.[8]

[5] OECD, Learning To Change, (2001) *ICT in Schools.*

[6] European Schoolnet, *The Think Report*, p. 37

[7] West Ed. Knowledge brief (2002) White N., Ringstaff C., Kellet L., *Getting the most from technology in schools.*

[8] Changing the conversation about teaching, learning and technology, 1995, Apple Computer Inc.

Current research in the UK focuses on the role of ICT in developing students' creativity and collaborative learning[9]. The outcomes of this research offer valuable insights into how ICT may in fact be a key trigger in supporting teachers to enable the kinds of learning espoused in the Primary School Curriculum, and in the review of the Post Primary Syllabuses. Teachers who engage with ICT in the classroom have reported that ICT is more suited to support collaborative learning, active learning, enquiry etc. than traditional teaching pedagogies. Additionally, the use of ICT in education has consistently been equated with other broader educational goals. For students these include time management skills, active citizenship, language and numeracy skills, and the student's own responsibility for learning

One of the more salient findings in the general research on the use of ICT in education is the extent to which ICT can support the inclusion of students with Special Educational Needs.[10] Research has shown that ICT can help students to overcome communication difficulties, and to access the curriculum more fully, through using communication aids and appropriate assistive technology and software tailored to meet their needs. In some instances ICT offers perhaps the only way in which some students can make their thoughts and needs known and demonstrate their achievements.

Research carried out in the UK between 1999 and 2002[11] showed a positive correlation between students ICT use and their overall academic achievement. A later study which examined other school factors such as resources and teaching found that ICT alone had little impact unless combined with good resources and effective use in the classroom. However, the quality of teaching both in general and with ICT had improved. Schools that had both good ICT resources and very good ICT teaching achieved better results than those with good ICT resources but poor ICT teaching.[12]

As gatekeeper of his/her students' classroom learning, the teacher continues to be a critical contributor to success in classroom learning -including learning with ICT. The teacher's own familiarity with ICT and confidence and competence levels in its use is a key determinant of the effective use of ICT in the classroom. ICT can also alleviate the administrative and planning burden for teachers in planning and managing lessons, resources, recording and assessment. There is a strong motivational link between the teachers' perception of personal value in using ICT and his/her use of ICT in classroom pedagogy. Access to ongoing and appropriate ICT professional development is a prerequisite for *all* teachers if they are to improve their confidence and competence in using ICT to meet the needs of *all* their students.

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[9] Keri Facer and Ben Williamson: Designing technologies to support creativity and collaboration:A handbook from NESTA Futurelab

[10] BECTA ICT Research 2003, What the research says about ICT supporting special educational needs (SEN) and inclusion

[11] BECTA, for the Department for Education and Skills (DfES) 2002). *ImpaCT2 : The Impact of Information and Communication Technologies on Pupil Learning and Attainment.*

[12] BECTA: January 2003, *Primary schools - ICT and standards* available at www.becta.org.uk/research/research.cfm?section=1&id=538

Taken together, these studies tout the potential of ICT to improve educational outcomes. Yet this ambition is not unprecedented in the history of instructional media. Even a cursory review of the impact of instructional media on educational outcomes reveals a significant disparity between the anticipated and actual (evidenced) effects of instructional media in classrooms and schools. Merely because ICT providers are creating hardware and software and their school customers are acquiring these tools and equipment, does not tell us to what extent the daily lives of typical school children and their teachers are being affected or changed by ICT. Our need to visualize the roles and functions of ICT in Irish classroom contexts has never been greater.

2.1.3 The digital divide

A third frequently cited rationale for the use of ICT in schools has been to mitigate the growing *digital divide* in our society. The digital divide refers to the gap in achievement between those who have access to technology in the home, and those who do not. International research indicates that the divide goes beyond ICT provision – children in working class homes who have a computer at home may be more likely to use the computer for games, while middle class children may more frequently use it for learning activities. ICT programmes have been established in some countries to attempt to bridge this divide. For example in the UK, a program for disadvantaged areas exists, *Closing the digital divide: ICT in deprived areas*, where schools in areas of high social deprivation are given free computers under the *Wired Up Communities* project. The role of parents and the wider community in supporting the work of the school in ICT are described as critical. Similar smaller scale projects operate in Ireland, the Liberties Learning Initiative and the DISC project in Dublin, with private and public sector funding both aim to bridge the digital divide for students in disadvantaged communities.

In addition to the lack of physical access to technology, limited literacy, numeracy, and problem solving skills have also been identified as a strong determinant of the digital divide for many people (ETS, 2001, OECD, 2001). The link between low levels of literacy and the digital divide indicates implications for children with special educational needs, those receiving learning support, and children from socio-economically disadvantaged backgrounds. This aspect of the digital divide has not yet been explored in the Irish situation.

Another aspect of this divide is the growing perception of a disparity between the uses of ICT in the school and in the 'real world' outside of the school, The use of digital media such as digital cameras, image editing, digital music is part of the accepted culture for many people, especially young people. Communication devices such as mobile phones and PDAs are in common use. The absence of congruity between this change in people's patterns of use of ICT and school uses leads to the perception by many students that school learning may not be relevant to the world. Exploring this question of relevance will be important in the NCCA's work in ICT in Curriculum.
As well as educational and social rationales for the use of ICT in schools, there has been increasing interest in the role of ICT in Education at policy level both from the European Union and from National governments.

2.2 European policy for ICT in education

The opportunities and challenges of the knowledge society have been broadly recognised in a number of European policies. In addressing the challenges and opportunities brought by ICT,

these policies attempt to set a framework for the development of opportunities presented by ICT to enhance the well being of European citizens. One of the first of these policies was the *eEurope – An information society for all* (eEurope) initiative launched in December 1999. This initiative recognized the challenges of the knowledge society. The key objectives of *e*Europe were:

- to bring every citizen, home and school, every business and administration, into the digital age and online.
- to create a digitally literate Europe, supported by an entrepreneurial culture ready to finance and develop new ideas.

The eEurope policy noted that ultimately the whole process should be socially inclusive, build consumer trust and strengthen social cohesion. [13]

One of the key priority actions for the second objective was *European youth into the digital age*. This action acknowledged the crucial role of education in determining economic and social progress and equality of opportunity in society. It recognised the importance of life-long learning to support the emergence of a new generation of creators, researchers, entrepreneurs and to empower all citizens to play an active role in the knowledge society.

The European Council at a special meeting on 23-24 March 2000 in Lisbon endorsed this recognition of the importance of the knowledge based economy and agreed a new strategic goal for the Union, that is

> *to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion by 2010.* [14]

The *eEurope Action Plan* was subsequently drawn up to define the necessary measures to ensure that the targets set out by the Lisbon European Council were reached. Two such *e*Europe action plans have now been developed: *e*Europe2002 and *e*Europe2005. Under the priority action, *European youth into the digital age,* the Lisbon European Council requested 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.[15]

[13] eEurope (1999) *eEurope – An information society for all*.

[14] European Council, 23-24 March 2000, Lisbon

[15] Commission Of The European Communities, (2002) eEurope 2005: An information society for all

Additionally, the Commission outlined specific educational actions in a complementary *e*Learning initiative adopted by the Commission in May 2000[16]. The *e*Learning initiative is part of the *e*Europe action plan with an additional objective;

> *to support the evolution of school curricula with the aim of integrating new learning methods based on information and communications technologies by the end of 2002.*[17]

Precise targets for education have also been laid down under *e*Europe:

- to ensure, by the end of 2003, that all school-leavers have had the chance to become digitally literate
- to provide all teachers with appropriate training, to adapt teacher training programmes accordingly, and to introduce measures to encourage teachers to make real use of digital technology in their lessons, by the end of 2002
- to offer every worker the opportunity to become digitally literate through the lifelong learning system, by the end of 2003.

EU member states have made visible progress in connecting schools to the Internet and in developing the ICT skills of teachers. However, more progress needs to be made regarding

- the quality of Internet connections and ratio of computers per teacher/student
- the match between equipment, available software, content, services and educational needs
- training for teachers and adaptation of both teacher and pupil curricula
- the concept of Digital Literacy
- *e*Learning indicators or standards
- modes of accreditation and certification

The direction taken in European policies is well reflected in Irish government policy for ICT.

2.3 Irish policy for ICT in education

The Irish government has also recognised the enormous significance of knowledge society developments on the educational sector, the Irish economy, and society in general. In the last decade, two Irish government policies for ICT in Irish Education: *Schools IT2000, A Policy Framework for the New Millennium* (1997) and *A Blueprint for the Future of ICT in Irish Education* (2001) have been published and implemented. The most recent *Blueprint* policy outlined the main thrust of the government's three-year strategy, which was

- to augment the ICT capital provision to schools and lower the computer/pupil ratio
- to expand access to and use of Internet technologies through the development of wiring-networking infrastructure
- to further integrate ICT into learning and teaching
- to enhance teacher professional development

[16] European Commission, 2000, *e*Learning**–***Designing Tomorrow's Education*

[17] elearning get ref;

- to facilitate the development of software and multimedia resources for use in schools

The lifetime of the *Blueprint* policy expired at the end of 2003. We are currently awaiting the publication of the next Government policy for ICT in Education, which is expected to continue with the previously stated goal of aiming to meet the EU e-learning initiative targets.
A strategic framework, *New Connections, A strategy to realise the potential of the Information Society* was published in March 2002 which outlined *overall* government priorities in supporting, embracing and benefiting from the Information Society in Ireland.

The Information Society Commission publication, *Building the Knowledge Society, A Report to Government* (December 2002) acknowledged that while Ireland has a strong reputation for a well-educated, highly-skilled workforce, it lags behind leading countries in the application of ICT to the education sector. The report recommends that basic ICT skills, should in as far as possible, be integrated as a core component of mainstream education and training provision.

The Information Society Commission (ISC) made a number of recommendations to government including

- priority for capital investment in ICT in schools supported by a clearer policy framework, and progress indicators
- political commitment to establishing a broadband connectivity solution for schools, education centres, libraries, and other places of community-based learning
- clear provision for integrated technical support for the education sector
- curriculum integration of ICT
- a review of the approach to ICT in teacher education, and identification of the professional development needs of teachers.

Some of these issues raised by the ISC are discussed in the next section where the NCCA presents an examination of progress on Government policies to date. Government policy for ICT in education is co-ordinated and implemented through the ICT Policy Unit of the DES, which is currently developing a policy for ICT in schools for 2004 and beyond.

2.31 EU and Irish ICT in education Policies: Progress

Schools IT2000, A Policy Framework for the New Millennium[18] (1997) led to the establishment of the National Centre for Technology in Education (NCTE) in 1998 to implement the policy. This was supported at local level through the appointment of twenty ICT Advisors in each of the fulltime Education Centres from September 1999 (later expanded to 21).

There were three major initiatives in IT2000:

- Technology Integration Initiative (TII)

[18] Department of Education and Science (1998). *Schools IT 2000: A Policy Framework for the New Millennium*

- Teaching Skills Initiative (TSI)
- Schools Support Initiative (SSI) including
    - Schools Integration Project (SIP)
    - ScoilNet

A further initiative, 'Interactive Software in the Curriculum' evolved as the implementation of IT2000 progressed. The role of ICT in supporting children with special educational needs (SEN) permeated all of the IT2000 initiatives.

The DES launched an updated ICT policy framework document, *A Blueprint for the Future of ICT in Irish Education*[19] in December 2001. This new policy supported the continuation of the main initiatives commenced under *IT2000,* and augmented capital provision to schools and lowered the computer/pupil ratio.[20]

These policies met with a positive and enthusiastic response from teachers, parents, boards of management, industry and the wider community. Technology grants to schools for hardware and software under TII were greatly augmented by contributions through public private partnership (e.g. Telecom Eireann), local sponsorship, and fundraising initiatives of parents, teachers, and the school community. Many teachers participated in ICT training in their own time under TSI. Hundreds of schools submitted innovative project proposals to participate in SIP[21] with a final number of three hundred eventually participating in over eighty projects. ScoilNet was launched as the educational portal for Irish schools. The Interactive Software in the Curriculum initiative resulted in the evaluation of many software titles and the development of a limited number of pieces of indigenous content. The SEN initiative permeated all other initiatives.

Research on the implementation of these policies was conducted in three nationwide school surveys in 1998, 2000 and 2002 in order to determine the delivery and impact of *Blueprint* initiatives and *Schools IT2000* in Irish schools. The findings were summarised in *Schools for the Digital Age, Information and Communication Technology in Irish Schools, Progress Report 1998 – 2002*[22], hereafter referred to as 'the Progress report'

In the next section we provide a short analysis of the findings from this report and the implications for the NCCA work in ICT in Curriculum and Assessment.

2.4 Moving forward with ICT in curriculum and assessment

It is clear from the Progress report that a lot has been achieved in Ireland since 1997. While acknowledging this progress, Ireland is a long way off meeting the ambitious goals of the eEurope Action Plan and the eLearning Initiative for 2002. Using data from the progress report, this section outlines positive steps to date and highlights priorities for future development in order to realise the goal of ICT integration in the curriculum.

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[19] Department of Education and Science (2001). *A Blueprint for the future of ICT in Irish Education*

[20] Department of the Taoiseach (2003). *New Connections: Government Action Plan, Progress Report*, p. 49.

[21] Galvin, Conor (Ed.) (2000). *Sharing Innovative Practice The NCTE's Schools Integration Project 1998-2000*

[22] NCTE (2004) *Schools for the Digital Age, Information and Communication Technology in Irish Schools, Progress Report 1998 – 2002*

In Ireland as internationally, developments in ICT in education in general have followed a pattern of **three** phases of implementation:

1. the development of ICT infrastructure in schools,
2. mainstreaming the role of ICT in education, and
3. using ICT to transform teaching and learning practices.

The third phase was the stated aim of the *Blueprint* policy, and is expected to continue to form a core section of the forthcoming Government policy for ICT in education from 2004.

An examination of comparative data and quantitative measures such as ratio of computers per student, and access to ICT per class in the Progress Report provides a snapshot of progress to date and a useful indication of some important directions for future development.

2.41 Infrastructure

Pupil: computer ratio has significantly improved in the years since the first ICT in Schools Policy and is now (2002 figures)

- 11.8:1 in primary schools
- 9.4:1 in post-primary schools
- 3.9:1 in special schools.[23]

These figures indicate that the question of adequacy of ICT infrastructure has not yet been resolved. For example, the availability of computers to students ranks low in comparison to our European neighbours, especially Denmark, 3:1, Norway 4:1 and Finland 6:1. [24] The availability and density of computers in school is important in order to promote certain kinds of ICT uses, for example, in class group work. A German report which conducted an international regional comparative study argued that a maximum of *6 pupils* per computer is needed in order to successfully integrate ICT in the school. [25] In Australia, the target is now 5:1 in most states.

The Progress report does not provide information on the availability of the broad range of ICT now recommended for use in educational settings: software, digital cameras, digital projectors, digital audio and video, communication devices and software, scanners, printers etc. It is important that we do not concern ourselves solely with numbers of computers, other ICT devices have great potential to support the development of students creativity, communication skills and media literacy. For example, a digital projector attached to an Internet connected computer in the class, can enable the teacher to use powerful multimedia resources in their teaching.

Maintenance and technical support of the infrastructure also determines to a large extent, teachers confidence and willingness to use it in class. This was cited in a report in 2001 as key issue and a time waster.[26] It is clear that a satisfactory system of technical support is necessary to support schools.

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[23] ibid.

[24] OECD, *Education at a Glance*, 2003.

[25] International Benchmarking Study, 2003 *IT in school regions*, Bertelsmann Foundation, Nixdorf Foundation

[26] KIA, Review, CRITE 2001, pg. 13

2.42 Access to ICT

In Ireland, the level of student access to computers varies by school level and class. Weekly and occasional access to computers becomes more frequent as children progress from infants to 6th class in primary schools. This age related increased usage pattern is not continued into post-primary. The highest rate of access in post-primary schools is during Transition Year, LCA and LCVP where students are undertaking projects, task work and portfolio work. Student access to computers in special schools is high.[27]

Though this information on access to ICT is useful, there is a need for more in-depth research beyond that described here. Seven years after the beginning of the investment in ICT in education, it is time we started to look beyond access to equipment, and to research usage patterns. Research is required to gain insight into the factors that promote usage, the quality of use of ICT in schools and classrooms, and the learning experiences which ICT affords students. The available figures do not give detailed information on the length of time the *individual* student (rather than class) spends using ICT per week, nor do they address the *quality* of this usage. Additionally, while the progress report notes that subject specific use of ICT is much higher in primary than in post-primary schools, with a particular focus on use in English, Mathematics and for Learning Support, it does not attempt to examine the *quality* of ICT use within subject areas. For example, *Is ICT 'use in English' primarily for word processing?*

Research is needed to fill these information gaps. We can gain greater insight into the situation by examining the experiences of those teachers and students who currently use ICT, how they use it and for what purposes.

2.43 Teacher ICT professional development

More than 75% of teachers have availed of some form of ICT training through the NCTE Teaching Skills Initiative.[28] This is a positive development as research indicates that those teachers who have received adequate and appropriate training use technology more frequently and in a variety of ways in their teaching instruction.[29]

While the progress report highlights this positive situation in relation to teacher participation in ICT professional development, ongoing progression in ICT pedagogy is still a requirement. The ICT courses for teachers provided under the Teaching Skills Initiative have greatly supported the development of teachers' knowledge and understanding of, and skills with the use of ICT. In order to fully take advantage of the opportunities afforded by ICT in teaching and learning, teachers need to be comfortable with the technology, and motivated to use it in supporting teaching and learning. When teachers perceive the benefits to their own work from using ICT (e.g. planning and recording) they are motivated to change existing practice and use ICT in the classroom. If ICT is to be available to *all students* then *all teachers* at both pre-service and in- service must have appropriate training.

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[27] ibid, p. 6

[28] Ibid.

[29] The Learning Return on our Educational Technology Investment, West Ed. 2002

Recent data from a Eurydice[30] survey highlights that most EU countries now include education in ICT as a compulsory component of the initial education of *all* future teachers. Ongoing research and investment in appropriate ICT professional development is also required. Recent research by BECTA has highlighted teacher ICT skill as one of five key pillars of successful integration of ICT in schools. In a discussion paper on cost, utility and the value of technology, Wahl (2000) recommended that funding for ICT should be allocated in the ratio of 70:30 on teacher training to equipment. This approach is gaining credence internationally. In Denmark, a training initiative for teachers, the pedagogical computer driving licence, Skole-IT focuses on the use of ICT to support innovative teaching and learning strategies in the curriculum. Initial reviews of effects indicate that the interaction between pedagogy and ICT skills is an important factor for teacher use of ICT in the classroom[31]. Similar views emanate from the SITES reports 2003. One case study from Norway, describes how teachers found that the most appropriate form of ICT training was when it was needed for the classroom task they were doing.[32] Collaborative support from other teachers within the school was also cited as a key area in the development of ICT competence. In Australia, states are developing ICT competency frameworks for teachers, with support, funding and training over a five year period.

It is also contended that the integration of ICT in teaching and learning requires a fundamental rethink for many teachers of their own deeply held beliefs and attitudes in relation to pedagogy, styles of teaching and their subject. [33] For example, teachers who are engaging with the implementation of the Primary School Curriculum 1999 might find that ICT affords greater opportunities to engage their children with collaborative learning, active learning, enquiry etc. than traditional teaching pedagogies, and enact a change in their own teaching as an outcome of this realisation.

Teachers have experienced increasing expectations to incorporate ICT into their teaching. Taking into account the age profile of teachers, it is reasonable to note that the majority of practising teachers did not receive pre-service training in the use of ICT. Most teachers work in independently in their own classroom with little interaction and supports from others, and if they encounter difficulties with ICT there is often very little assistance or support available to them. The rapidly changing nature of technology also renders much ICT professional development inadequate or out of date in a relatively short period of time, months not years. Relying on one week workshops and seminars is not sufficient given the diversity of ICT and the rapid changes involved.

Changes in teaching pedagogy happen slowly and incrementally, and in response to a realisation of the need for change. Teachers will be enabled to do so, through empowering teachers to become more involved in questioning their own practice and to become engaged in communities of practice. Such models of professional development, currently enacted in other jurisdictions require supportive central mechanisms and coherent planning.

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[30] Key Data on Information and Communication Technology in Schools in Europe, Eurydice, 2004, p. 45

[31] Skole-IT Impact Study 2,Uni C, 2002

[32] SITES report NO004, Integrated use of ICT supporting an active student school, Royse Primary school, Norway, p. 2

[33] Lai, K. W. (1999). Net-working: Teaching, Learning and Professional Development with the Internet. Dunedin, NZ: University of Otago Press. (1999, p.12),

2.44 School leadership

The key role of principals in the successful use of ICT in learning and teaching was recognised with a series of nationwide seminars for principals organised by NCTE through the network of Education Centres in 200.. These seminars focused on providing support for schools in implementing DES policy in planning schools' ICT infrastructure, staff professional development, and ICT curriculum integration.

Planning for ICT at school level is fundamental to its successful integration within the school. Research has shown that when principals realise the benefits of ICT in their own work, they are more likely to encourage its use within the school.[34] Encouraging and supporting the use of ICT for both school administration and planning is vital to enhancing the place of ICT within schools.

2.45 Connectivity and Internet access

While every *school* was connected to the Internet under the Telecom Eireann Information Age scheme, only a proportion of *computers* had access to the Internet. This ranged from 33% in special schools, 39% in primary schools to 66% in post-primary schools. Analysis of the type of connectivity afforded to schools revealed that only a minority of schools had broadband connectivity (mainly ADSL & Satellite) with the majority of users in post-primary schools using narrow bandwidth (PSTN line or ISDN line) to access the Internet. 6% of post-primary schools provided broadband access, compared with 1% of primary schools and 2% of special schools. In primary schools, Internet access was typically provided through a standard telephone line, thus limiting users to having one computer on-line at a time.

The Government Broadband Strategy was designed to alleviate this situation commencing from 2004. The provision of high speed, always on-access to the Internet for schools as part of a broader policy of integrating ICT into education, has now become a national imperative.[35] The Government has recently partnered with the Telecommunications Industry Federation (TIF) to agree a joint €18 million program to fund the provision of broadband to all schools. The National Broadband Network for Schools, supported by HEAnet will consist of a high quality virtual network which will provide high-speed broadband connectivity, centrally managed network services and always-on broadband access to high-quality multimedia content for schools.[36] This development will replace the current situation where the majority of schools have a single dial up connection, with only 2% of schools nationally having broadband access in 2002. [37]

The move to provide Broadband access to all schools represents a significant positive step forward, however, it is nonetheless simply an access technology, and its potential value in

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[34] College for School Leadership

[35] *New Connections,* op cit.

[36] Department of Communications, Marine and Natural Resources, (2004) *Broadway: Regional Broadband Programme Connecting A Global Community, Educational Supplement.*, p. 3

[37] NCTE (2004), *Schools for the Digital Age, Information and Communication Technology in Irish Schools, Progress Report 1998 – 2002, p. 11*

education is as an enabler for learning. The question remains whether broadband connectivity will be supported by the development of ICT based curriculum resources which are relevant to the curriculum and assessment needs of teachers and students. There is currently a dearth of such home-grown curriculum-based ICT programmes and products developed by, and shared with, Irish teachers and students. Some innovative examples of locally-developed web-based or CD-Rom resources have been well documented in Sharing Innovative Practice, the proceedings of the SIP symposium, (2000). The need to create and identify online resources which support best practice in curriculum and assessment and can be disseminated nationally, is now more urgent in the context of this Broadband initiative.

2.46 ICT and Special Needs

The progress report provides figures on the resourcing of schools catering to students with Special Educational Needs. Appropriate ICT should be available to all students with Special needs regardless of setting. There is a need to have a greater understanding of *how* students with special needs have *access* to and *use ICT* in *all* classroom settings, supplemented by recommendations on how ICT can support inclusion and support for the needs of students with Special Educational Needs in various settings.

Changes in our perceptions of Special Educational Needs offer opportunities for more inclusive classrooms. Developments in learning theory, such as multiple intelligences and research on learning styles have led to a move away from a uni-dimensional view of how people learn, to a realisation that individual difference in learning capacities extends across the entire range of students. Rather than viewing some students as *able* and some as *less able*, there is an increasing awareness that *every* student brings an individual combination of strengths, needs, and interests to the classroom. In attempting to cater for the broad range of individual difference the teacher is encouraged to utilise a broad range of teaching strategies and approaches, as well as a variety of visual, audio and kinaesthetic learning resources.

ICT can support the provision of a differentiated curriculum to support individual needs as it affords *individual* access to more varied media, tools, and methods. For example, students who have difficulty with a print focused curriculum may have greater opportunities for learning, in an environment with greater access to audio and image related resources. Students with a visual impairment have increased access and learning opportunities through media such as talking books, descriptive videos, and screen reader software.

Assistive technologies which include a broad range of devices and technical aids can improve the quality of life of people with disabilities. Students with physical disabilities may previously have been unable to access the curriculum because of communication or physical difficulties. Now, using a computer and a flexible range of assistive technologies, for example augmentative and alternative communication devices, both low tech and high tech, their experience of learning can be transformed. Within classrooms there is an increased focus on the inclusion of all students. Classrooms which were previously inaccessible for many students with disabilities can now support inclusion for students who may require devices such as switches, mouse tracker balls and other peripherals to support access to the curriculum and learning resources.

In such ways, ICT can support the broader educational goals of inclusion of students with differentiated needs within adapted classroom layouts.

2.47 The digital divide

The progress report did not find evidence of a digital divide in Irish schools. Findings suggest that schools in disadvantaged areas were in fact somewhat better *equipped* than others. On the other hand, a significant amount of ICT infrastructure came from local fundraising. Such a situation can lead to disparity of provision as it is dependant on local circumstances. As highlighted earlier, the digital divide is not just measured by levels of equipment, but quality of usage and literacy levels.

The question of equity for all students and optimum use of ICT resources are of concern in the imbalance noted between the use of ICT in Primary and Post primary schools. From the progress report figures, it is possible to conclude that a cohort of children who use ICT *regularly* or *frequently* in the primary school transfer to post primary where they may not use ICT at all or *rarely*. Such anomalies between the sectors contribute to the digital divide which exists for many students. Factors described as contributors to the imbalance in ICT usage between primary and post-primary schools include the design of the school day, the siting of ICT in laboratories rather than in classrooms at post primary and the examination driven nature of the second level sector.

In order to determine suitable models of ICT integration for post primary schools, it is necessary to further examine the relevance of these and other factors which effect increased usage at post primary such as

- in creased awareness of the potential uses of ICT within the school
- targeted funding
- provision of subject specific professional development
- the role of ICT as an integrated part of curriculum and assessment.

If the potential advantages of ICT are to be available to all children, this issue of equity and access will require further examination. While many Irish schools have embraced ICT (due to the availability of ICT equipment, high levels of teacher interest, local skills, etc.) this can by no means be seen as widespread. As the pace of technological change increases, schools that have not yet taken advantage of the opportunities afforded by ICT are at risk of becoming increasingly marginalized. Conversely, schools that have been involved in special projects (e.g., SIP) have had a significant advantage over their non-participating peers.

A significant number of schools have some ICT equipment, but use it infrequently. There is an urgent need to bring on board those schools which have not yet embraced ICT. Students in these schools will be disadvantaged in relation to their peers in other schools if this situation is not resolved. Models of ICT use which can be adapted to varying school circumstances and contexts are required, along with targeted supports in training and implementation to address this situation. More in-depth research and information is required into useful models or indicators regarding what uses of ICT are most effective, and in what circumstances and subjects particular interventions are successful.

The rationales for ICT in education cited at the beginning of this section propose ICT learning as a required life skill for all students. It is important that we do not lose sight of this goal. We should not become fixated on expectations of return on investment in ICT and significant gains in student achievement. These expectations need to be balanced with our overall values in education and how ICT can contribute to these.

This section began by illustrating arguments which promote ICT as a pervasive part of everyday life, work and leisure, and by implication, of education. It outlined some of the more frequently touted benefits of ICT for teachers and learners in schools. It acknowledged the ways in which European and Irish policies have begun to explicate the potential role of ICT to contribute to the well being of citizens, lifelong learning and the development of the economy. The section concluded by describing the developments in ICT in Irish education to date including the two government policies for ICT in Education; *Schools IT2000, A Policy Framework for the New Millennium* and *A Blueprint for the Future of ICT in Irish Education*. These policies represented significant investment in infrastructure connectivity and teacher professional development and resulted in the increased availability and usage of ICT in schools and in teaching. It also outlined areas requiring progression in the next phase of ICT policy to enable the integration of ICT in curriculum and assessment.

3. Defining and envisioning: ICT in Curriculum and Assessment

The focus of this discussion paper *Curriculum, Assessment, and ICT in the Irish Context* thus far, has been on examining the situation to date concerning ICT in education. We have also discussed the possibilities and future potential of ICT in primary and post-primary schools. Now, we will begin to examine this potential through exploring the research and debate around ICT literacy and move towards developing a vision for ICT in Curriculum and Assessment.

In the past decade, discussions of ICT in education have increasingly focused on the skills, competencies, and attitudes necessary to prepare students for education, life, and work in the digital age. It is widely recognised that these 'knowledge society' attributes build on, and necessitate, a strong literacy foundation. In many instances it is claimed that ICT and the knowledge society represent a paradigm shift, which redefine what it means to be literate in the 21st century.

A number of terms and definitions have been used to describe the needs of 21st Century students and citizens. These terms include ICT skills, technology skills, technological literacy, IT literacy, ICT literacy, information literacy, visual literacy, media literacy, digital literacy, and broader concepts such as literacy in the digital age, 21st century skills, and FITness (fluency in/with information technology).

In moving towards developing our vision for ICT in education, it is important for the NCCA to use clearly understood terminology and language. The selected terms, definitions, and features of ICT should represent an agreed educational philosophy and vision across primary and post-primary education; should be meaningful and relevant to teachers and students; should be broad enough to encompass a wide range of uses; and should be consistent with the best international research and trends. However, that is not to say that terms and definitions chosen will be forever the same; language like literacy and technology is an ever-changing phenomenon, rapidly superseded by newer phrases and definitional terms.

Many definitions regarding the use of ICT describe skills with specific tools – the ability to use a word processor or search engine, or to configure an input/output device. While such definitions have the benefit of specificity and measurability, they also present problems. They quickly become out-dated. They tend to be tool-dependent definitions which specify skills afforded by ICT. But most importantly, they do not typically encompass the higher order thinking skills so necessary in this knowledge based society.

In reviewing research, there is a much greater reference to literacy than to skills in this context. Educators have come to expand the notion of literacy to include the skills and abilities that will enable citizens to function in an increasingly technological world. Terms that are most commonly used are Information Literacy, ICT Literacy and to a lesser extent Digital literacy. There is significant overlap and intermingling of concepts within the terms, outlined in turn, below.

3.1 Digital Literacy

The term Digital Literacy appears in many government policy documents as a goal to be achieved by students and adults. A precise target had been laid down under *e*Europe[38] and *e*Learning[39] Action Plans to, 'Ensure that all pupils have the possibility to be digitally literate by the time they leave school.' As part of *New Connections*[40], a key goal of ICT policy is 'to significantly increase ICT education and training so that as many adults as possible have the chance to become digitally literate'.

Building the Knowledge Society[41] states that 'Given the increasing importance of digital literacy, the application of ICT at primary and secondary level education is clearly of fundamental importance'.

While the term Digital Literacy enjoys significant occurrence in government ICT Policy documents, it currently receives much less attention, rigour, and explication in ICT and education academic research.

Digital Literacy does however receive noteworthy mention throughout *Learning to Change: ICT in Schools*[42], which states that Digital Literacy 'is a fundamental learning objective for all'. In the publication, Digital Literacy is described as

> *'more than ability to use a computer in simple ways, and both are fundamentally important. It implies a sophisticated set of competences pervading workplace, community and social life, including information-handling skills, and the capacity to make judgments about relevance and reliability when searching on the Internet.'*

However, the concept of digital literacy is not further expanded in the publication.

In the *Investigating Children's Emerging Digital Literacies*[43], digital literacy is viewed as a set of habits students use in their interaction with information technology for learning, work, and fun. Specifically, the set of habits comprising this definition of digital literacy includes the following five dimensions

- *their troubleshooting strategies;*
- *the range of purposes connected to their computing*
- *their skills in using common tools such as word processing, email and web searching*
- *their communication literacy – how they use email, instant messaging, and other tools to talk to peers and adults*

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[38] Council of the European Union & Commission of the European Communities (2000), *eEurope2002 Action Plan, An Information Society for All* (p.14).

[39] Council of the European Union & Commission of the European Communities (2001), *eLearning Action Plan, Designing Tomorrow's Education. for All* (p.3).

[40] Information Society Policy Unit, Department of An Taoiseach (2002), *New Connections, A strategy to realise the potential of the Information Society, Government Action Plan.*

[41] Information Society Commission (2002), *Building the Knowledge Society-Report to Government.* P59,

[42] OECD (2001), S*chooling for Tomorrow, Learning to Change: ICT in Schools*. P 15

43 Journal of Technology, Learning and Assessment, Volume 1, Number 4 (2002). Investigating Children's Emerging Digital Literacies. Harouna Ba, William Tally, and Kallen Tsikalas. P6.

- *their web literacy – how they use the web to find, cull, and judge information and their skill at creating web based material themselves.*[44]

The above attempt at exploring the term Digital Literacy is in no way exhaustive, but suggests the need for greater agreement regarding the tenets of this phenomenon.

3.2 Information Literacy

A frequently encountered term in the review of literature is Information Literacy. This term is primarily associated with school library programmes in Australia and the US.

Information Literacy encompasses many of the skills and competencies necessary to live, work and learn in the knowledge society. There are numerous definitions, models of information literacy, and sets of standards that have acquired particular importance in the educational sector internationally.

One such definition states

> *Information literacy is the ability to identify information needs, seek out resources to meet those needs, and then analyze, synthesize, evaluate, and communicate the resulting knowledge.*[45]

Documentation pertaining to Information Literacy often lists the attributes of an information literate student. For example, information literate students:

- *are competent, independent learners*
- *actively engage in the world of ideas*
- *confidently solve problems*
- *know what is relevant information*
- *use technology tools to access information and communicate*
- *operate comfortably in situations where there are multiple answers or no answers*
- *have high standards for their work and use information ethically*
- *create quality products*
- *are flexible and adapt to change*
- *are able to function independently and in a group*[46]

Thus definitions of Information Literacy frequently include Information Literacy standards, which are generally expanded into performance indicators and levels and aligned to other subject specific standards of the curriculum, to facilitate the integration of information literacy across the curriculum. While the higher order thinking skills of analysis, synthesis, and evaluation gain credence within definitions of Information Literacy, the communicative competencies deemed critical for students in the 21st Century are not included within this term.

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[44] ibid

[45], [38] Colorado State Library, Colorado Department of Education (2002), Standards for Information Literacy and School Library Program. P2

3.3 ICT Literacy

While the debate on what constitutes ICT literacy is ongoing, the concept of literacy itself is also being re-examined. The International Reading Association in 2001, claimed that

> *To become fully literate in today's world, students must become proficient in the new literacies of ICT* [47]

and suggested that educators have a responsibility to integrate ICT into the literacy curriculum and can no longer ignore how the Internet and ICT have changed our notions of literacy. This expanded notion of literacy includes the broader range of comprehension strategies required for accessing and evaluating web-based texts and resources.

In January 2001, Educational Testing Service (ETS) convened an international panel to study the growing importance of existing and emerging ICT and its relationship to literacy. The panel published its report in May 2002.[48]

The panel had two specific objectives

- to examine the need for ICT literacy across countries as well as within specific organizations including schools and businesses.
- to develop a workable *Framework for ICT Literacy*.

This framework will provide a foundation for the design of instruments including large-scale assessments intended to inform public policy and diagnostic measures to test an individual's ICT skills. While the focus of the study was on assessment of ICT Literacy, the work of ETS also provides a strong background for curriculum development with ICT Literacy.

In examining the need for a measure of ICT Literacy, the panel agreed and explicated a comprehensive definition of ICT Literacy

> *ICT literacy is using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society.*

This definition encompasses the cognitive facets of Information Literacy but also includes an emphasis on the use of technology. The framework recognises that ICT Literacy can only be adequately defined when technology skills and cognitive skills, such as literacy, numeracy and problem solving are integrated. ICT Literacy needs to be appropriately integrated into the curriculum. However, the above definition is very functional; it fails to recognise the interest, attitudes or experience of an individual set within a particular social or cultural context. It neglects to highlight the importance of constructing new knowledge and the ability to communicate such knowledge in this knowledge based society.

A further evolution of the ETS definition and ICT Literacy Framework has been undertaken by an ICT Expert panel established by OECD/INES Network A in preparation for the

[47] International Reading Association. (2001). Integrating literacy and technology in the curriculum: A position statement.

[48] Educational Testing Services (2002), Digital Transformations – A Framework for ICT Literacy, A Report of the International ICT Literacy Panel.

measuring of ICT Literacy skills in PISA 2006. In a report[49], the ICT Expert Panel adopted the following definition of ICT Literacy:

> *ICT literacy is the interest, attitude and ability of individuals to appropriately use digital technology and communication tools to access, manage, integrate and evaluate information, construct new knowledge, and communicate with others in order to participate effectively in society.*

Similar to the ETS report, the OECD definition of ICT Literacy was fully teased out and explicated. The OECD Expert Panel noted that:

- ability alone to use ICT is insufficient for developing ICT proficiencies. Individuals also need the motivation, interest and belief that ICT literacy makes a difference to their lives and need to enjoy using ICT.

- the 'appropriate use' of ICT encompasses facets such as using ICT with fluency, understanding the potential of ICT and the social and ethical issues related to the use of technology.

- communicating information/knowledge is a critical component of ICT Literacy.

- ICT literacy allows individuals to contribute to and benefit from society including the educational, economic, political, leisure and cultural life of a society.

Similarities in the ETS and OECD definitions include an understanding of

- ICT as a set of activities and technologies that reflects the convergence of IT and communication technologies
- literacy as dynamic, allowing individuals to continuously learn, grow and participate fully in society. Literacy includes the traditional domains of reading and numeracy, but educators have come to expand the notion of literacy to include the skills and abilities that will enable citizens to function in an increasingly technological world.
- digital technology, communication tools include hardware (e.g. computers, networks, digital cameras, cellular phones, data logging equipment, joysticks, etc) and software (WP, email, chatrooms, games, simulation, music composition etc)
- processes which are essential components of ICT literacy, i.e., access, manage, integrate, evaluate, construct (create)

Access	Knowing about and knowing how to collect and/or retrieve information
Manage	Organising information into existing classification schemes
Integrate	Interpreting, summarising, comparing and contrasting information using similar or different forms of representation
Evaluate	Reflecting to make judgments about the quality, relevance, usefulness, or efficiency of information

[49] OECD (2003), Annex B: Assessing Information and Communication Technology (ICT) Literacy in PISA 2006. Report of the ICT Expert Panel.

Construct/ Create	Generating new information and knowledge by adapting, applying, designing, inventing, representing or authoring information

- different formats through which information may be presented including text, graphs, images, sound, video, animations etc.

The OECD definition of ICT Literacy provides a comprehensive description of desirable ICT related literacy for 21st Century citizens. It not only encompasses the skills, attitudes and abilities needed by all citizens, it is broad enough to include a wider range of technologies (image editing, music technology, CAD, Control Technologies, etc), interest and skills that may not be necessary for every individual to know to participate in society, but may be required by some to engage in a particular field of work, study or interest.

This OECD definition of ICT literacy for students and teachers presents *opportunities* to transform *how, what and where* we learn. It suggests that ICT affords opportunities for teachers to

- reduce the emphasis on curriculum content and focus on development of skills and processes
- promote directed and collaborative project-based learning
- facilitate creative, critical thinking and informed decision making
- support a range of learning styles through the use of visual, auditory, and kinaesthetic media
- cater for the range of individual needs, in particular, students with special needs
- enable an appropriate pace of learning to be selected for the individual student
- facilitate students in preparing and presenting work in multimedia formats
- create new teaching and learning environments
- broaden assessment methods
- enhance students self esteem and promote positive and motivational learning environments
- provide students with modern day experiences.

While this latter explanation suggests a broad role for ICT in education, it does not fully encompass the expanding opportunities using ICT in the knowledge society. Additionally, the use of ICT in education has consistently been equated with other broader educational goals. These include ensuring equity for all students, developing self responsibility for learning, developing time management skills, developing active citizenship, supporting language and numeracy skills, the role of ICT in the changing scientific culture, and the acquisition of lifelong learning skills.

These broader challenges of what is referred to as the *information society/knowledge society* have profound implications for curriculum and for schools, teachers and students and suggest that ICT has the potential to transform *all* aspects of student education including

- curriculum content
- approaches and methods and
- tools for teaching and learning.

The NCCA will need to probe our understanding on a number of points including

- what it means to be *literate* in an increasingly technological world, and
- the notion of *ICT literacy* as a fundamental requirement and a right for all future citizens.

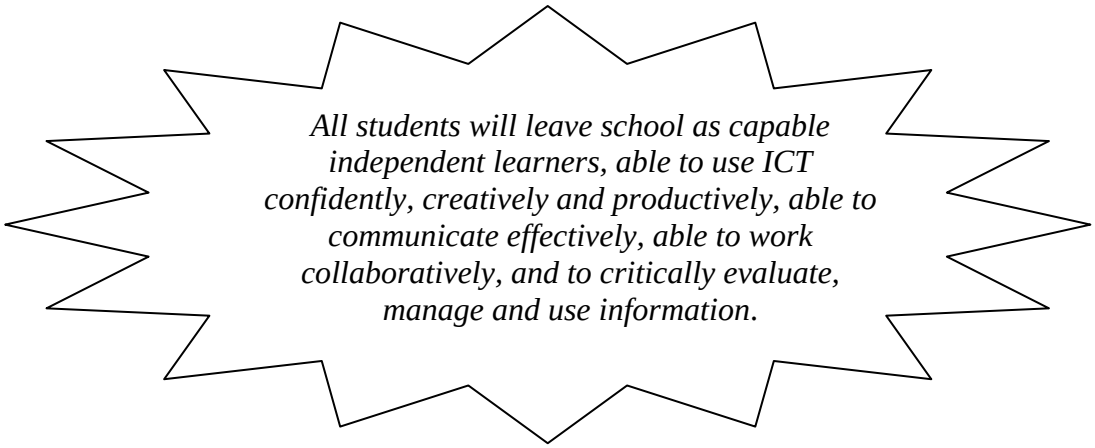
The OECD definition of ICT literacy in its broadest sense has been described as the summation of the new literacies and competencies which allow individuals to contribute to and benefit from society including the educational, economic, political, leisure and cultural life of their society[50].

While this explanation suggests a broad role for ICT in education, it does not fully encompass the expanding opportunities for using ICT in the knowledge society, the development of the range of media literacies, and the broad range of personal capacities which can be developed through the use of ICT

3.4 NCCA Vision for ICT in Curriculum and Assessment

This sets the stage for the NCCA to articulate its vision of what precisely are the ICT knowledge, skills, and attitudes required of Irish students in the 21st century.

The NCCA vision for *ICT literacy* can be encapsulated as follows:



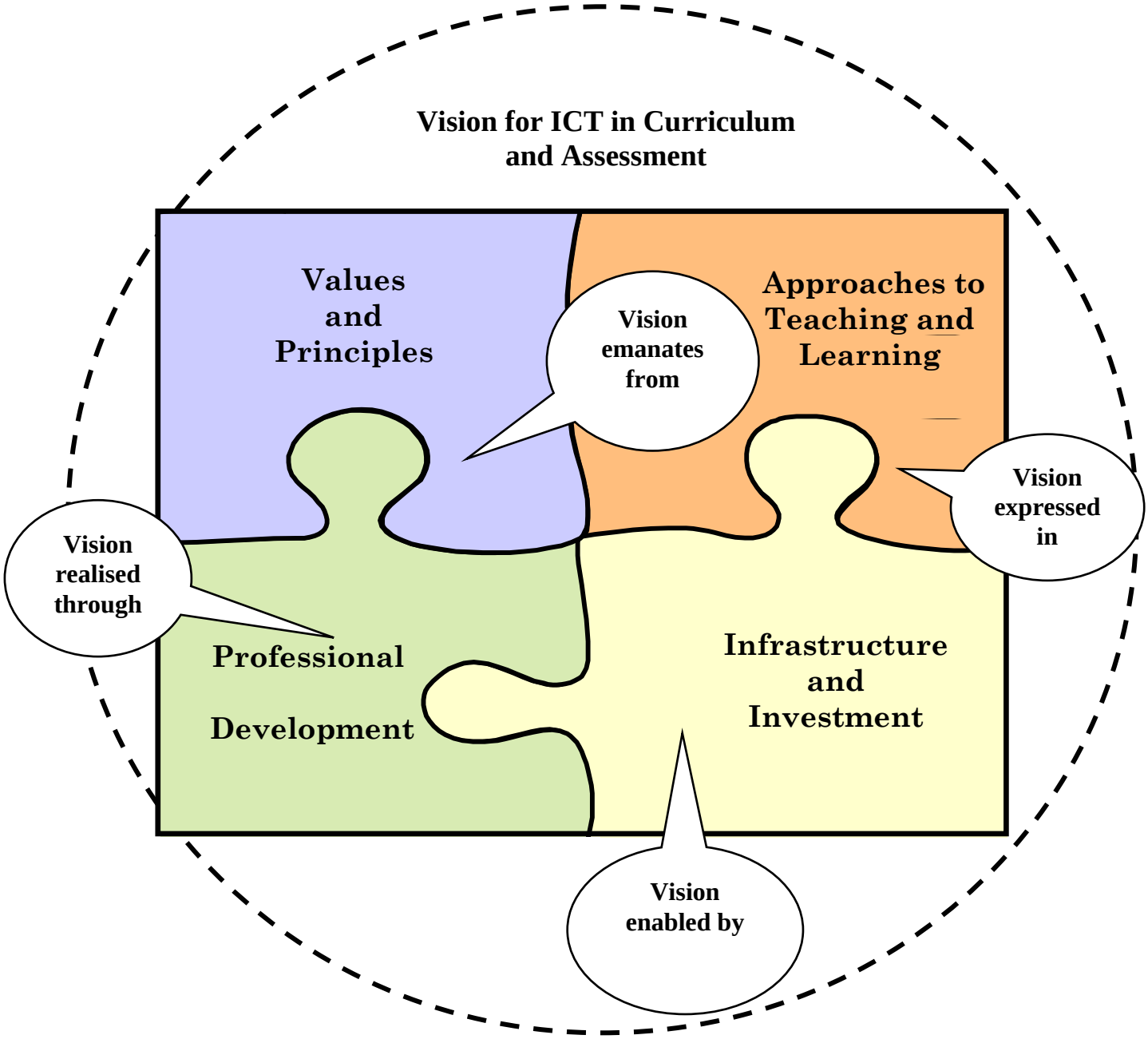
This vision incorporates the following principles

- All students should have equity in terms of access and use of ICT.
- Decisions on the use of ICT in school should be based on and integrated with the general aims of education at the appropriate level
- Teacher professional development in ICT pedagogy is a fundamental requirement
- The integration of ICT to improve students learning and to prepare them for lifelong learning, should be an integral part of every school's plan
- All teachers and students should have access to appropriate ICT infrastructure, bandwidth and resources and online content to support the Irish curriculum.

In proposing this vision for ICT in Curriculum and Assessment, the NCCA is aware that it presents both opportunities and implications for Curriculum and Assessment, and will require a range of supporting measures. This vision is further developed in the next two sections.

[50] Organisation for Economic Cooperation and Development (2001). Schooling for Tomorrow; Learning to Change: ICT in Schools.

Four interlocking and interdependent elements are required to complete this vision for ICT in Curriculum and Assessment.



4. Developing the vision: ICT in Curriculum

Central to the discussion of ICT in education in Sections 2 and 3 are questions regarding the implications of the knowledge society for *what* students should learn in schools, as well as *when* and *how* they should develop these skills, knowledge and attitudes.

Throughout history, humans have invented technologies that radically change what they are able to see, do, and think about over time. All learning tools are mediated by human goals and activities, and governed by beliefs or values about learning. Similarly ICT affords a new suite of cognitive tools for learning including productivity and knowledge amplification tools for accessing information, interpreting and organising information, analysing the wider world, and representing what learners know to others.

5.1 Principles of learning with ICT

Questions regarding what, how and when to learn with ICT tools and equipment require a clear understanding of how ICT can support learning, and how it fits with existing pedagogical practice. Learning to use ICT is not a goal in itself: we do not have goals citing the ability to learn using a book or other resource. A more laudable goal for ICT is the use of ICT to afford new and enhanced opportunities for learning that would not have been available to the majority of learners without ICT. This goal places the student at the centre of any model of ICT use in the curriculum.

A number of learner-centred principles regarding how students can best learn and develop as individuals are now widely accepted. These learner-centred principles emphasize the active and reflective nature of learning, and as such, represent best practice. The basic premise of these principles is that improvements in education are more likely to be achieved when the focus is on the learner.

The NCCA has articulated a set of 7 key principles to guide learners' use of ICT in their primary and post-primary education. Each principle is explicated below.

*ICT adds value to the curriculum when it supports students' **active involvement** in their own learning.*

Students learn complex subject matter best when they are engaged in the process of constructing meaning from information and from their own experience to meet their own goals. Students can use ICT in enquiry based learning to build on their own existing knowledge and experience to follow their own pathway to learning based on their educational needs. The developmental nature of learning affords students the opportunity to expand on and broaden previously held knowledge, skills, and attitudes. ICT can facilitate such learning in a number of ways, for example, through guided searches such as Web quests, topic lists, and project guides for younger students. Older students, who have refined search and analysis skills, can explore detailed resources to complete a project or task. When completing a project in a class with peers, students may also be actively involved in using ICT tools such as digital cameras, word processors, informational CD ROMs, image editing software, printers, and publication or presentation software to create a professional looking result. Through such active engagement in learning, students also acquire a range of supporting ICT skills.

ICT adds value to the curriculum when it supports the development of students' ***higher order thinking skills.***

To be successful adaptable learners, students need to use a variety of critical thinking, problem solving, and reasoning strategies to help them reach learning goals. Increasingly, creativity is viewed as central to the development of a student's ability to work imaginatively and with a purpose, and to create critical responses to problems across all curriculum areas. ICT can support the development of students' problem solving strategies in a controlled environment. For example, software programmes that incorporate problem solving tasks often provide students with multiple chances to try out their ideas, something which is closer to the real world solution-finding pattern of 'hypothesise, try, test and try again'. Students can be encouraged to develop their trouble shooting strategies, overcoming the tendency to try once and then give up. In such ways, the use of ICT based simulated environments can test students' understandings and develop their complex problem-solving abilities in controlled problem-solving situations.

ICT adds value to the curriculum when it supports student learning in ***authentic environments.***

The student's learning is influenced by his/her environment, including the cultural context, resources, technology, and teaching approaches and methodologies. Teachers are continuously engaged in managing and adapting the interactions between these factors to suit the needs of the individuals within the class.

ICT can add value to a learning situation when it is used to create experiences that are more similar to the kinds of learning that take place in daily life, for example, adventure based problem solving scenarios and dynamic scenes that show concepts that are difficult to explain in words. Students have success in learning when they can link new information with existing knowledge in meaningful ways, and when they are stimulated to use inert knowledge (knowledge that can be recalled when the learner is prompted to remember it, but that is not spontaneously used to solve problems) in relevant situations. To support the transfer of learning to new situations, this new knowledge has to be integrated with the student's prior knowledge and understanding.

ICT can provide the learner with the opportunity to apply concepts in a variety of contexts, breaking down the barriers between the learning in the classroom and the real world. Through the Internet, students can access up to date information on scientific explorations, access sites such as NASA's space and satellite pictures, and access the same sort of tools as professionals would use, for example, access archive collections normally only available to specialist researchers when examining periods in history. A number of collaborative global projects exist where students can contribute to research and development of databanks, for example the Global Environmental Watch project.

*ICT adds value to the curriculum when it supports student **interest and engagement** in learning.*

Motivation is central to learning. ICT can enhance the students' motivation to learn when their natural curiosity is engaged, and when it affords opportunities to adjust levels of difficulty, to follow individual pathways of interest, and to pace the learning to their needs. Engaging learning environments are evident where students are actively involved in completing interesting, relevant tasks and creating artefacts using real tools such as digital cameras, audio devices, etc.

Learning requires effort and a certain sustained commitment when engaging with a learning task over an extended period. Motivation levels will affect the willingness of learners to pursue a difficult task or goal in order to succeed. The engaging nature of ICT can stimulate learners to provide the sustained effort which may be required to accomplish a learning task. For example, when learners are working as part of a team to produce a multimedia project, their will be encouraged to put in the effort required to produce an item that is valued by their peers, and worthy of being brought to a certain audience. ICT also affords learners opportunities to practice concepts and skills in exciting environments, thus aiding the reinforcement of what is learned.

*ICT adds value to the curriculum when it supports **differentiated learning** for all students.*

Learning is most effective when the nature of individual difference in terms of physical, intellectual, emotional, language and social development is taken into account. Individuals learn best when material is appropriate to their developmental level and is presented in an enjoyable and interesting way. Teachers can use ICT environments to cater for the range of individual difference and the range of learning styles. ICT can also afford great opportunities to assist learners who have physical disabilities and who may need assistive technologies to access learning resources. For example, with the use of switch devices or screen reader software, learners can now access learning resources that were previously inaccessible. Students with physical disabilities can now take part in collaborative learning projects with their peers in the classroom, which may previously have been unavailable to them. For example, some children who could not physically go on a field trip were engaged in remote access to their peers, and communicated in real time with their cooperative leaning peers using wireless and mobile technologies.

The ready availability of multi-modal learning opportunities through ICT, where students can learn using a combination of graphic, visual, aural, and text based resources, can support students who may have difficulties when learning is mediated through one of these channels alone. Learning experiences enhanced by visual, auditory, or kinaesthetic resources can support all students, but may be especially supportive to students with special educational needs.
ICT can support the teacher in creating optimum conditions to support each individual student's development, through facilitating the creation of individualised tasks and materials suitable to the student's stage of development and learning needs.

Some of these materials can enable students to monitor their own completion of the task and so become competent self directed learners.

*ICT adds value to the curriculum when it supports **collaborative learning.***

Learning is greatly influenced by our social interactions, interpersonal relations, and communication with others. Collaboration is viewed as important in developing students' abilities to evaluate and justify their opinions, to gather and share knowledge with others, and to transform their existing understanding. Students are now offered enhanced opportunities to collaborate and communicate with their peers in classrooms around the world, through the Internet, email, videoconferencing, electronic bulletin boards, interactive whiteboards, and other electronic communications. Students can work on collaborative projects with peers in other countries, contributing to the development of their cultural awareness and a sense of global citizenship in addition to supporting specific curriculum goals.

Within the classroom itself, students are frequently engaged in co-operative group projects when they work as members of a team to create an overall product. In so doing, students develop skills in negotiating, managing time, cooperating with others, supporting others and taking responsibility for delivery on time, in achieving the overall shared goals. Students' self esteem, sense of acceptance and belonging are also enhanced by participating in collaborative group projects.

*ICT adds value to the curriculum when it supports **assessment of and for learning.***

Assessment provides important information to both the student and teacher throughout the learning process. Students are motivated and challenged to learn when they understand the goals of learning, and when they themselves have some say in setting their own goals. Assessment is accepted as a regular part of the cycle of teaching and learning. ICT can support assessment in a number of ways; for example

- when it is used to maintain portfolios, examples and records of the student's progress, for example eportfolio where the student learns to maintain and mange a record of his or her own work.
- when it is used formatively; to show the student his or her stage of achievement in a task; when instant feedback is available to the student. It can improve the students' ability to self-appraise, enhance motivation and promote self-directed learning. It can help the teacher and student to decide on the most appropriate next stage of learning or learning task, and decide whether further support is required

When deciding *whether* to use ICT and *what ICT to use* in a particular curricular context or subject, it will be necessary to evaluate it in the context of its contribution to supporting the learning goals of the student.

4.2 An approach to teaching and learning using ICT

In practice, educational uses of ICT in curriculum and assessment can be described in three ways. A co-ordinated developmental approach to the students' developing ICT literacy will incorporate *learning about, with,* and *through,* ICT.

Learning with ICT:	teachers and students use ICT resources to support the classroom curriculum
Learning through ICT:	teachers and students use ICT to learn in new ways that would not previously have been possible
Learning about ICT:	students develop skills in, and knowledge of, the potential uses of ICT

Learning with ICT:

Learning with ICT focuses on teaching and learning in a curriculum context using ICT. Teachers and students use ICT resources to support the classroom curriculum, for example, using tools such as word processing to create written materials, using presentation and authoring software to present projects, using drawing and painting software to enhance work in visual arts. In certain ways, learning with ICT may be perceived as a natural integration of ICT with existing classroom processes. Thus ICT can be used interchangeably with tried and trusted teaching and learning methodologies. As teaching and learning with the curriculum continues to evolve and change so too will teaching and learning with ICT in the curriculum. As ICT becomes more pervasive in our daily activities, it will also become inseparable from, and an integral part of teaching and learning.

Learning with ICT also supports learning, through the use of 'practice' type software to reinforce concepts already learned, or to access digital encyclopaedia or other resources. Thus, learning with ICT supports self directed learning by affording students enhanced opportunities to select individual paths to learning.

Learning through ICT:

Learning through ICT may automatically include learning with ICT, but it focuses on teachers' and students' use of ICT to engage with the curriculum in ways that would not previously have been possible without ICT.

Learning through ICT results in more authentic learning experiences for teachers and students. Previously, students could access a certain level of resources and materials at first hand, but much classroom learning was achieved through vicarious experience. In cases where the real or actual experience is out of reach, ICT offers another dimension, which is virtual. For example, using the Internet, students in classrooms can now access live data from NASA, (which supports the curriculum in science) and have the same opportunities to analyse data as real scientists. Students can engage in virtual 'field trips' in space, back in time or within the human body. A group of students could meet the goals of their history curriculum/syllabus by

engaging in local historical research using online databases and archive records, and create a web page or other artefacts as learning outcomes.

ICT offers opportunities for students with disabilities and with Special Educational Needs to access the curriculum using appropriate assistive technologies and/or specialised communication software and hardware, and to learn in ways that would not have been possible previously. The potential of ICT to control the pace of learning and to adapt to individual learning needs allows greater opportunity than heretofore, for all students to realise their potential.

Students can also use the authentic 'tools of the trade' of many occupations, with ICT. For example, even quite young students can master the basic tools of image editing software, something which was previously the preserve of graphic designers. Not only is the student learning to use 'real' tools to pursue his/her own interests, but by manipulating and editing image, he/she develops media literacy, learning to be more discriminating in evaluating media messages, and able to judge what is real versus what is enhanced.

Learning through ICT also supports the development of students' creative, critical, and higher-order thinking skills. For example, creative thinking may involve applying and adapting existing technology to deal with new problems and situations, or applying new technology to existing activities or processes to make them more effective. Examples of this form of creative thinking can be seen in the use of ICT in the creative arts, in design, and in the development of digital media.

Among the other opportunities afforded is the use of ICT to accelerate or replace tasks which were previously time consuming and not inherently valuable in themselves. Using productivity tools to record data and plot graphs for science experiments may be one instance. Until recently, opportunities to learn and engage with others at a distance in real time were perceived as beyond the realm of the school. Today, students can collaborate in real time with their peers and with experts, on global or local projects, via email, interest groups, discussion fora and so on. Video conferencing is a valuable means of communication where literacy barriers may have prevented communication in the past. Opening up the classroom to the wider world in these ways provides students with a stimulus to communicate for real purposes, and also to examine the appropriate forms of communication for the audience. For example, if there are barriers of language, image may be selected as the mode of communication. In such ways ICT can break down barriers to learning created by physical isolation, lack of resources and cultural or language difference.

Learning about ICT

Learning about ICT has many facets and includes the development of knowledge of and skills in, the potential uses of ICT to support learning. It includes students' development of ICT skills in a curriculum context. In learning about ICT students develop an understanding of what ICT is available and how and where it is used in society, in leisure and in people's work lives. Successful use of ICT by both teachers and students is dependant on this basic understanding of *what it can do.*

> Learning about ICT is not simply about the acquisition of ICT skills. Learning about ICT is not simply the acquisition of ICT skills. It also concerns understanding new developments in ICT, their potential to afford new experiences, and the skill sets they require. In this way learning about ICT is not the same as initial skills training; rather, learning about ICT is ongoing throughout our lives. Learning about ICT also entails understanding the human, social, and ethical issues concerning ICT and learning *when* to use ICT, *what* ICT is most appropriate, and *how* to use it to support a learning situation or task

The spiral nature of all learning is also evident when learning using ICT. At the same time as the student is learning *with* and *through* ICT, he or she is also learning more and more *about* ICT. The development of the student's own knowledge and interest in the potential uses of ICT to support learning will in itself lead the student to use ICT in increasingly innovative and useful ways, supporting the goal of lifelong learning.

The use of ICT in the curriculum in these co-ordinated mutually supportive approaches will enable the student to use ICT confidently, competently and creatively to develop the concepts, skills and attitudes appropriate to the student's age and stage of development.

4.3 Value added learning with ICT

To further extend this discussion of ICT use by teachers and students, a number of vignettes providing snapshots of authentic actual practice in a selection of Irish primary and post-primary schools are outlined below. The aforementioned principles of learning with ICT are inherent and embraced in each of the scenarios.

Learning Support and ICT

> A third class student attending a small primary school on an island off the south west coast of Ireland was receiving learning support from a teacher from a local mainland school. Provision was proving difficult due to poor weather conditions, which resulted in infrequent ferry crossings. Both schools were involved in the StarTech – Learning Together SIP project that involved using videoconferencing to link up geographically remote schools. It was decided to investigate the possibility of providing the student's learning support through video conferencing. There was initial concern that the technology would 'get in the way' of learning and that the student would feel uncomfortable and different. This interaction through videoconferencing proved hugely successful. The one-to-one support and differentiated learning path enabled the student to participate in mainstream classes with his peers. It was noted that his confidence, communication skills, and ICT skills significantly improved. The student looks forward to his weekly sessions on telly!

Modern Languages and ICT

> Two years ago Sandra completed her Junior Certificate in a Dublin based school and moved to Munster due to parental career changes. She is a good student with a considerable interest and aptitude for modern languages. She hoped to pursue Spanish and Italian for her Leaving Certificate. Unfortunately no school in the area provided both of these languages. Sandra was participating in the transition year option in her new school when her Spanish

teacher became aware of her predicament. Her teacher was aware of a language software company who provided digital language learning solutions by providing customised multimedia interactive courses and access to a teacher through email and/or videoconferencing. With the assistance of her teacher and school and in collaboration with the company, a digital course has been developed for Sandra pertaining to LC Italian syllabus. She is in regular contact with her 'remote' teacher through email; both text files and sound files (for oral work) are sent as attachments. Sandra also has access to additional resources through the web and is part of a cyber class with one other student from Ireland and eight others from various parts of the UK. They constantly communicate in Italian through email, chat-rooms, and web cams. Sandra also communicates with students from Italy. Sandra is learning Italian within real life authentic contexts. She is very familiar with the social, cultural, economic, political, and educational life in Italy through her engagement with up to date resources on the web and interaction with Italian teenagers and her teacher. She is being provided with a rich variety of learning experiences. As she says '*Un'esperienza assolutamente fantastica!'*

Concept Mapping with ICT

Pat, a primary teacher of junior classes first encountered Kidspiration about eighteen months ago at a software support group session held in his local Education Centre. As the presenter demonstrated the different aspects of the package and as Pat had the opportunity of playing around with the software at the session, he just kept saying to himself 'wow! The children in my class would enjoy this!'

Kidspiration is concept-mapping software, which utilises the principles of visual learning helping emerging young learners build confidence as they learn to associate pictures and words. Visual maps, story webs, diagrams, and outlines assist students in brainstorming, categorizing and organizing their thoughts. Pat uses Kidspiration to encourage the children to brainstorm ideas, to organise their thinking, to record their thoughts visually, and to put shape and direction to their work. He finds it particularly useful in helping the children to develop their reading and writing skills, in creating exciting stories in English, and in understanding the connections between their learning in areas like History, Geography, and Science.

Many of his colleagues are now using the software package with their classes for History, Geography, Science, Mathematics etc, where children are not just learning facts, but seeing the interrelationships and interdependencies between different aspects of what they are learning.

The older children in the school are using the more sophisticated package called Inspiration. This version of the software has additional functionality.

Leaving Certificate Applied Programme and ICT

The Leaving Certificate Applied (LCA) cohort of students from an all boys secondary school was the cause of some concern. Many exhibited low self-esteem, lacked motivation, had high absentee rates, poor retention and some

displayed behavioural difficulties. The school has a long tradition of strongly supporting students at risk. A number of years ago it was decided that a different approach would be taken with the cohort of students then in year one of LCA. It was felt that high levels of ICT utilisation with a focus on preparation, production, and presentation of research work would both motivate and engage the students. Having secured funding for the project through the SIP initiative, a laptop was acquired for each of the students and a wireless network installed in the school. ICT skills based courses were organised for the teachers involved with the students and the parents of the students. The parental involvement proved to be most important with parents showing enhanced interest and support for their child's educational experience. Students had access to their laptops for every class and were allowed take them home. Word-processing, spreadsheet, presentation, and photo editing software were on all of the laptops. They also had access to other technologies including multimedia CDs, scanners, digital stills and video cameras and the Internet. They worked on their project both individually and in groups. Student ICT skills improved immensely and this very much showed in the preparation and presentation of their work. Student self-esteem, maturity, communication, problem solving, organisational skills and teamwork improved significantly. Students blossomed under the special treatment. Behaviour and attendance rates improved drastically, with 100% of the students progressing from year one of LCA into year two. This had never happened before! Students felt their employment opportunities and advancement to further education was greatly enhanced both by acquiring a wide range of ICT skills and the many other personal and social skills they developed.

Teaching Geometry with ICT

A post-primary mathematics teacher really enjoyed teaching all aspects of the Junior and Leaving Certificate mathematics courses except the geometry section. She never liked geometry since she was taught it herself in school. It was perhaps the way she was taught geometry that was the root of her discontentment. 'Learn the construction by heart, learn the proof by heart. Write it down, attempt the cut!' There was no real expectation of understanding. If one it to be truthful, she may have approached teaching geometry in a very similar manner herself until she encountered the dynamic geometry software package, the *Geometers' SketchPad (GSP). GSP* brought geometry alive both as a teaching and learning experience. Students were shown the basic tools and were given more complex constructions to construct themselves. They measured everything, dragged their constructions by the vertices, centres, and sides, and watched for patterns, what changed and what stayed the same. Students worked on their own and in groups coming up with their own conjectures, had 'theorems' called after them. Understanding now comes first and formal proof later. Geometry has come alive. Students are actively engaged in their own learning and involved in geometric constructions and investigations not previously possible. Student higher order thinking and problem solving skills have been greatly improved. Teachers may now demonstrate more complex concepts and look at many case scenarios that were not previously possible due to time and other constraints.

In the above vignettes ICT is not being employed for its own sake, but to support teaching and learning within an authentic context. ICT also has the potential to transform learning environments, provide opportunities allowing students engage in experiences not previously possible, and broaden assessment modes.

Some key decisions are required of the teacher when planning for the use of ICT in the curriculum. A key question to pose in making this decision is

> *Does the use of ICT in this case enrich the student's learning experience in English, mathematics, science, history, language, visual arts, etc, etc.? If so, in what ways?*

The following questions may be useful as a summary aid to selecting when and how to integrate ICT in the curriculum.

Does this use of ICT

- *interest and motivate the students to learn?*
- *promote independent thought, and active, and enquiry based learning?*
- *appear relevant, inclusive, and interactive?*
- *encompass sound pedagogical principles?*
- *cater for the wide range of learning abilities and styles in the class?*
- *help to develop students ICT abilities?*
- *enhance learning skills such as critical thinking, problem solving, higher order thinking skills and analytical skills?*
- *involve both teachers and students in learning and facilitating learning?*
- *offer opportunities for collaborative learning and team work and the development of social skills?*
- *support the transfer of learning to other real situations?*

This section described a learner-centred approach to using ICT in the curriculum. The principles of learning with ICT show how students' learning in the curriculum can be enhanced by ICT. A tri-fold approach to learning using ICT advocates learning *through*, *with*, and *about* ICT to enable students to obtain the maximum learning benefit from modern ICT. A number of snapshots showing such uses in practice illustrate and illuminate the potential of ICT to support learning across the curriculum for all students.

5. Developing the vision: ICT in Assessment

It is widely acknowledged that curriculum and assessment are inextricably linked: discussions concerning curriculum invariably have consequences for assessment and vice versa. Assessment is an integral part of the process of teaching and learning. This section offers introductory discussions on some of the possible scenarios for development of ICT in assessment.

The section begins with a review of the purposes of assessment which include

- improving students' classroom learning. Students learn more effectively when they know what they have done, when they understand what they need to learn, and when they are given the tools to succeed
- supporting teachers and schools in monitoring and reviewing their curriculum plans
- assisting policy makers in targeting the allocation of resources including, for example, specific interventions to improve learning outcomes
- providing a passport to third level education and the world of work. The established Leaving Certificate is one example of these summative assessments.

The Primary School Curriculum outlines a framework for assessment in the primary school, noting that assessment should mirror the full range of the child's learning, encompassing the cognitive, creative, affective, physical and social dimensions of his/her development. The NCCA policy paper on Assessment (February 2004) outlines a broader view of the role of assessment and envisages assessment for learning and assessment of learning as two complementary and interrelated processes.
The focus of assessment *for* learning is on assessment as a normal part of the cycle of teaching and learning. The teacher develops a picture of the child's progress and attainment through classroom observation, evaluating the child's questions and responses, the quality of his/her involvement in class and group activities and through tasks and tests. A portfolio of work or a project conducted over a month or a term provides further information on the child's long term progress. ICT is now being used in many instances in this way. Examples of project work using ICT were documented in the SIP projects, and a number of these projects were included as exemplars in the ICT Primary Guidelines. The inherent ability to maintain a trail of the child's usage and performance using ICT could be used to add to the teacher's repertoire of assessment tools. The use of ICT in assessment particularly in the developing and maintaining electronic portfolios is an area that requires further exploration at primary level.

At post-primary level, there currently exists a predominant focus on summative assessment. To a large extent, this is very much influenced by the current nature of the Junior and Leaving Certificate state examinations, where the vast majority of marks are allocated to terminal examinations held in June of the final year.

Within the current reviews at both junior and senior cycle there is much support for changes to the current assessment model, particularly in relation to the timing and forms of assessment. There is a focus on ensuring that there is congruence between the aims and objectives of syllabuses and their assessment, that appropriate forms of assessment will be established for each area of the curriculum, reflective of the aims and objectives of each syllabus. The broadening of assessment methods (e.g. the inclusion of second assessment

components), and the number and timing of assessment events over two or three year cycles are under consideration and in some cases development. The embedding of skills and capacities in subjects and short courses will be a feature of the developmental work taking place in 2004-2006. Where appropriate and feasible, the assessment of these skills and capacities will be part of the assessment of subjects and short courses. Meeting the needs of all students continues to be a key focus; there will be a greater focus on differentiation of learning outcomes and assessment, which will facilitate greater access to subjects and short courses for a wider range of students.

As part of the Junior Cycle review, a developmental initiative in *assessment for learning* is currently taking place in a number of schools in Sligo and in Cork. Initial outcomes from Year One of the initiative indicate that there are positive effects for both teachers and students. Teachers reported positively particularly on the flexible nature of assessment for learning. The wide variety of approaches employed, the ready transferability of the skills to other subjects, and the contribution to reporting to students and parents were viewed by participants as supportive of teaching and learning. For students it had a positive impact on motivation, including those perceived to be reluctant learners, and there was an increased sense of students becoming more autonomous learners and more involved in the teaching and learning process. In Phase two of this project the number of schools and teachers involved will be expanded, and the reporting process to parents will be examined.

The NCCA's current work programme for assessment includes exploring the potential role of ICT in assessment, specifically

- the use of ICT as an assessment tool (knowledge, skills and capacities) including the use of electronic portfolios
- the use of ICT for the administration and management of assessment (recording, storing, analysing and presenting results from a variety of assessment methods)

In general, it is fair to note that the use of ICT in assessment is developmental and exploratory. That said, however there are currently a number of examples of best practice where ICT is widely employed in supporting assessment both nationally and internationally.

5.1 Value added Assessment using ICT

The vignettes below provide snapshots of authentic practice in using ICT to support assessment in Irish primary and post-primary schools.

LCVP Electronic Portfolio

A school in the North East of the country first introduced the Leaving Certificate Vocational Programme (LCVP) in September 1995. From the onset the use of ICT played a major role in supporting the programme. Typed letters were produced to invite in guest speakers from the local area to address the class, posters were produced advertising LCVP initiatives using both word processing and desktop publishing packages. ICT very often formed the basis of mini-company products such as personalised stationery, yearly local calendars, framed abstract art, and a video promoting their school.

Initially, while the curriculum vitae was the only portfolio item for assessment that was required to be typed, students in fact presented all of the portfolio items in typed format using software packages. They found the opportunity of presenting their work in a professional well laid out format very motivational. They also put extensive effort in drafting and redrafting all items of their portfolio using editing facilities of word-processing packages. Students produced many letters, plans and reports on LCVP activities suitable for inclusion in their portfolio; however they had to decide which items to include for assessment purposes.

Both teachers and students were delighted to be invited to participate in the Schools Integration Project (SIP), which involved students presenting their entire LCVP portfolio in electronic format. This opportunity offered a natural progression of work already being carried out in the school by the LCVP students.

Students and teachers involved in this project found it both challenging and rewarding. In the initial stages, the most challenging aspect was the inclusion of video clips in the portfolio because the technology (analogue video camera) available to them at the time was both cumbersome and slow. This has since become much easier with the availability and purchase of a digital video camera.

The majority of students and teachers find the opportunity to produce the entire LCVP portfolio in the form of an interactive CD motivational, beneficial, and interesting. The experience allows students to develop their planning, collaborative, creative, decision making and ICT skills.

Electronic Portfolio in the primary school

A disadvantaged inner city primary school began working with electronic portfolios in preparation for parent-teacher meetings. The teachers and management of the school wanted to showcase the work of children in fourth, fifth and sixth classes, to monitor children's progress and to motivate and engage children using novel approaches. The focus was on developing literacy with an emphasis on story making and story telling.

Children composed stories about their own area and their own experiences. (Poetic license did somewhat prevail!) The children hand wrote many stories and these were scanned into the computer. In some cases they typed the stories using a word processor. Twice a year, the children were asked to select a story to read aloud and answer questions on. This process was videoed. The video clip was included in an electronic portfolio of the child's work which also contained the text of the story, a brief comment from the student on why he/she choose that story, and teacher comments and observations.

The recording twice a year allowed the parents, teachers, and children to observe and monitor progress over time. The children were involved in the assessment process as they chose the story they wished to record. Fifth and sixth class children prepared their own portfolios under the guidance of the

teacher. The first attempt was a somewhat chaotic experience for all involved, the school is now in their third year of using this method of recording children's work and all (most) involved find it a rewarding experience.

Diagnostic assessment using ICT

Anne is a shared learning support teacher amongst three rural schools in the midlands. She meets on a weekly basis with twenty-four children, and liaises with seven classroom teachers, two resource teachers, classroom assistants, principals, parents and occasionally educational psychologists and Department Inspectors. She also carries out diagnostic testing on students, prepares reports and develops individual education plans (IEPs) for children in collaboration with classroom teachers, on a regular basis.

ICT has been her lifesaver! She attended a Phase 1 ICT course under the Teaching Skills Initiative (TSI) in the summer of 1998 and received a laptop computer in early 2000 partially funded through the Technology Integration Initiative (TII), and since then she has never looked back. Anne constantly uses ICT in supporting her work both inside and outside the classroom, using interactive software with students to support their learning, preparing classroom resources, IEPs, reports, storing and managing student data, communicating through email, researching using the Internet and diagnostically testing students. Anne continues to participate in courses and augment her software supply.

She believes the diagnostic testing software is the most useful type she contains in her software arsenal. Titles include *Lucid CoPS Cognitive Profile System, Lass Junior,* and *Lexia Quick* and *Lexia Comprehensive Reading Tests.*

These software programmes record student cognitive skills, such as short term memory, phonological awareness, decoding skills, reading comprehension, rate, and fluency. The software accurately records each student's responses and generates a graphical profile of his or her cognitive abilities using standardised norms. These programmes can assist in predicting dyslexia and other learning difficulties in young children. Using this profile along with other methods such as teacher observation and professional judgement, the teacher can create Individual Educational Plans for students as appropriate.

Anne finds these tools very useful in her suite of strategies for diagnostically testing students.

In addition to the snapshots outlined above a number of schools are utilising standalone multimedia software titles, Integrated Learning Systems (ILS), many of which incorporate computer assisted assessment systems. Topics covered in class may be complemented and reinforced by the use of interactive multimedia software, where students may progress through the package at their own pace. Many of these software packages have a testing

facility within the packages, which primarily utilised closed objective testing methods, including multiple choice, true/false, specific answers, and drag and drop questions. This type of testing possesses many advantages over its paper-based counterpart. It can provide private learning spaces for students, interactive multimedia environments, and instant feedback. Many of these software titles have the facility to provide adaptive testing. This is a form of testing, which changes as the test progresses, that is the student's response to the first few questions may alter the subsequent questions. This is particularly useful for students with special educational needs. Many software packages also have the facility to record student progress and issue some type of report or profile of student progress for teachers, parents, and students.
Many schools are also using computer games and simulation software. This type of software has the advantage of being able to animate, simulate or model situations and concepts in a controlled environment, thus allowing students to observe, interact with, problem-solve and interpret phenomena and reinforce and consolidate classroom activities. This type of software may also be used to demonstrate and assess certain concepts, (e.g. dangerous experiments) which may not otherwise be feasible in a classroom situation.

Computer database systems can be used to manage the process of recording student information including assessment results from an administrative perspective, particularly at post-primary level.

It can be seen from above that ICT is beginning to be utilised to support and enable assessment in Irish primary and post-primary schools. However, such use is neither widespread nor consistent; nor do we fully take advantage of or fully realise the opportunities that ICT presents in the use and management of assessment.

It is important that curriculum addresses the needs of the twenty first century and assessment exhibits coherence with the curriculum. Learning has traditionally required students to be good consumers of information. Meeting the demands of the knowledge society will require shifting student learning to a higher gear from activities that use knowledge to activities that help students become information seekers, analysers, evaluators, innovative thinkers, problem solvers, decision makers, communicators, and producers of knowledge. A wider range of assessment methods are necessary for such types of learning, while still maintaining the reliability of assessing in high stakes assessment environments.

ICT has the potential to make a significant contribution to new forms of assessment. However, focused research must be undertaken before widespread use of ICT in assessment is embraced. Many of our colleagues in other jurisdictions are engaging in slow but incremental integration of ICT into the assessment process while others are engaged in transformative uses of ICT for assessment purposes.

5.2 Assessment Initiatives Internationally

The Qualifications and Curriculum Authority (QCA) in England and the Council for Curriculum, Examinations and Assessment (CCEA) in Northern Ireland have undertaken and a number of ICT and assessment initiatives with various partners in education and industry. These include

5.21 eVIVA

The eVIVA project was a joint research project for KS3 engaged in by the QCA and Ultralab, with ten schools in England from June 2002, using online portfolios and an

oral assessment via mobile phone. The aim was to explore multiple media literacies which are not well acknowledged by other assessment processes.

The first stage began with students looking at some questions for the end of the course to ascertain what they knew already. The students then posted milestones onto the eVIVA website, online portfolios of their ICT work to show what they knew and could do, the processes they used, and the decisions they made. They could annotate comments explaining their thinking and noting key moments in their progress. Teachers, parents and peers could also add annotations and feedback online or via SMS. When students completed their portfolio, they took the eVIVA telephone assessment on their mobile.
Phase one was completed in July 2003 and an evaluation of findings indicated benefits for both students and teachers. Students were motivated, had increased self expectations and confidence; and felt empowered by the sense of audience in an online space. Teachers expressed satisfaction at the easily accessible online portfolio, and the opportunity to have a one-to-one dialogue with students. Phase two of the project is refining the instrument and exploring further the experiences of annotation, and the sense of audience, and whether the evidence gathered via the eVIVA leads teachers to make more accurate assessments of student performance.

5.22 The Edexcel and CCEA Paperless Examination Project (PEP)

The Edexcel and CCEA Paperless Examination Project (PEP) was a pilot scheme to develop online mock GCSEs in biology, chemistry, and geography. It has been in operation for three years and now caters for cohorts of over 1000 students. PEP provides a clear example of a limited technical modification of a paper-based examination. The on-screen version uses a linear approach, replicating the original format of the paper-based assessment. Completion of the test involves text-based entry into dialogue boxes.

Additionally, within the project there are some questions where the technology is used effectively to change the experience of the assessment process, and the skills and knowledge used to answer the question effectively. Questions where video clips are used for example, require students to apply their observational skills as well as their geographical understanding to answer the question. Such uses are motivational for students.

Interestingly, while students completed the entire examination using ICT, the marking was done using a combination of computer-based and human markers (for the open text answers).

5.23 Electronic scanning of GCSE papers

A large sample of GCSE papers in a particular subject were scanned electronically and electronically distributed to the markers, where markers could add comments and marks in a special column to the right of the script. The purpose of this initiative was to commence engagement with using ICT in the marking of high stakes examinations. It was primarily used to assess the markers level of comfort with ICT. It also facilitated the distribution and redistribution of scripts where markers met with some

difficulty. It enabled automatic collations of results and immediate recognition of trends. It also greatly reduced the possibility of loss or damage of scripts.

5.24 The Enigma Project

The Enigma Project, conducted in Singapore by the University of Cambridge Local Examinations Syndicate (UCLES) from 1997-1999, compared the performance of students taking paper-based tests with computer-based tests. An evaluation of the trials showed that computer based testing was feasible although there were many technical, administrative, and educational issues to be addressed before such tests could be used by all.[51] In the Singapore evaluation, it was noted that using ICT essentially to replicate and replace traditional paper based tests has no significant advantage in terms of moving towards more authentic forms of assessment.

5.25 World Class Tests

World Class Arena is an international initiative designed to identify and assess gifted and talented students around the world. It was devised by the British Department for Education and Skills (DfES), and Arena items have been trialled by teachers and students in the UK, Australia, New Zealand and the US.

Designed for very able 9 and 13 year-olds in maths and problem-solving, World Class Tests utilises a paper-based and technology-based hybrid of assessment material and uses dynamic graphical representations, which probe various levels of students' understanding. Questions vary from a text-based entry to describe an understanding of what is happening on screen, through to the analysis of complex on-screen data-sets, of a type which would be totally unfeasible to replicate in paper-based tests. Often students are asked to write their conclusions on paper, the point of which is to keep the focus firmly on examining the students' abilities through whichever media they are best able to articulate themselves. In this model, the use of ICT changes radically the skills, knowledge, and understanding being assessed. The software is enabling the development and assessment of the higher order skills valued in today's society.

5.26 QCA Key Stage 3 ICT test project

The question of assessing skills and competence using ICT is an issue for discussion. For example, in the UK, the QCA Key Stage 3 ICT test project has developed a windows-type environment, which provides students with an opportunity to demonstrate the ICT skills they have learned. Student are given access to a walled garden of websites in order to conduct on-screen research, to get hints on skills like combining and presenting information, and to gain access to a wide range of web-based resources. While students are being assessed through their on-screen work, the examiner is able to eavesdrop electronically on what the students are doing in order to make judgements about their capability. Ultimately, the examiner is able to test a wider range of skills, such as the ability to research and present information, rather

[51] Robert Harding, Nicholas Raikes; (2002) ICT in Assessment and Learning: The Evolving Role of an External Examinations Board, University of Cambridge Local Examinations Syndicate (UCLES)

than simply assessing the students ICT skills. The first phase of the project is a Technical Pilot, which is currently taking place with 2% of schools across England. On completion of the Technical Pilot, a National pilot of the KS3 ICT onscreen tests will take place in the summer term of 2005.

The snapshots of a number of initiatives above demonstrate the use of ICT supporting, enabling and in some cases transforming assessment. Progress is also being made in the development of automatic essay assessment software internationally. However, considerable research and development is necessary before such assessment tools will be widely available.

This section acknowledges the potential of ICT as an integral part of assessment *of* and *for* learning. It also recognises that much of this work is at an embryonic stage. There are some questions and directions raised by these international developments which can enlighten the NCCA in its focus on the role of both assessment and ICT in primary and post-primary education. Among the areas to be investigated in the Irish context are, assessing ICT learning, the use of ICT as an assessment tool, ICT in the management of assessment, and the role of ICT in assessment *for* learning.

6. Building the NCCA work programme

A number of challenges for the NCCA's ongoing work in ICT, curriculum and assessment have been highlighted in this paper. The NCCA's response to these challenges will be operationalised in the further development and refinement of the NCCA's current work programme for ICT in curriculum and assessment. There are three main strands of activity in this ICT work programme.

Each strand, identified in Figure 1 addresses one key question as follows:

1. What is the role of ICT in Curriculum and Assessment?
2. What learning experiences (knowledge, skills and attitudes) should ICT afford students at key phases in their primary and post-primary schooling?
3. How can the NCCA best support teachers' and students' use of ICT in curriculum and assessment?

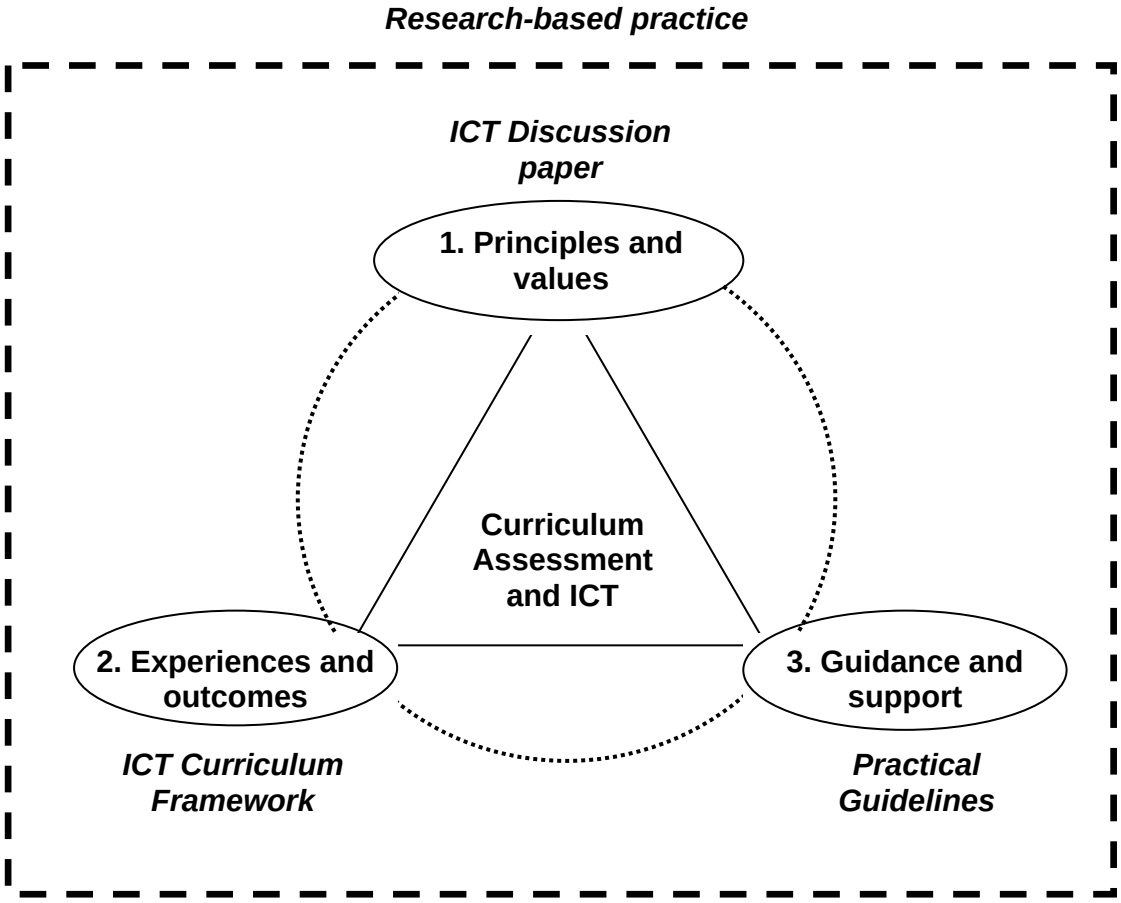


Figure 1. Strands of the NCCA programme of work for ICT in curriculum and assessment

1. **Curriculum, Assessment and ICT: A discussion paper**
   This discussion paper, *Curriculum, Assessment and ICT in the Irish Context* sets out a rationale for ICT in education and sets forth the NCCA vision in terms of values, beliefs and approaches in relation to ICT in curriculum and assessment. It will serve as a foundation to guide the direction of the work of the NCCA in ICT in curriculum and assessment.

2. A Framework for ICT in Curriculum and Assessment

The *Framework for ICT in Curriculum and Assessment* currently being developed will be a central element in achieving the NCCA vision of ICT literacy for all students. The Framework will identify the kinds of ICT learning experiences; (knowledge, skills and attitudes) students should be afforded as they progress through their primary and post-primary education. The *Framework for ICT in Curriculum and Assessment* will be presented in four broad learning domains

- Communicating, expressing creativity, enquiring and problem solving
- Using ICT productivity and communication tools
- Developing operational knowledge and concepts
- Developing critical awareness of the personal and societal impact of ICT.

It is envisaged that these domains will be explicated further in a number of key learning experiences, with descriptor statements at four levels showing the types of activities a student working at that level would be able to achieve. It is expected that a child leaving sixth class in primary would be able to achieve the descriptors in level two, while students would be able to achieve the descriptors in level 3 by the end of compulsory education. The descriptors will be supported by exemplars and sample activities, for that level, and presented electronically. The descriptors will be phrased in a way that they will also be a guide for assessment.

The purpose of the ICT Framework is to

- provide a rationale for ICT in the curriculum
- identify the kinds of ICT learning experiences (knowledge, skills and attitudes) students should be enabled to achieve by the end of their primary and post-primary education described within broad domains of learning using ICT
- enable schools and teachers to select curriculum aligned content and teaching methods consistent with local contexts and priorities
- provide opportunities for students to demonstrate mastery of ICT knowledge, skills and attitudes at the end of their primary and post-primary education.

This framework assumes that learning *about* ICT is a fundamental element of learning *with* and *through* ICT. For teachers, engaging their students in learning about ICT can be a big challenge – one which requires significant school, classroom, and curriculum planning. The questions of when students should learn ICT skills, who should teach these skills, in what context, and for how long, are all critical to the development of the framework, and ultimately to teachers' use of it.

Questions regarding whether or not, or to what extent the framework should address students' development of *specialist* ICT skills within specific subjects, will also be explored when developing the framework, but these skills may be included in short courses or modules or embedded in different subjects at post primary level. (for example, students' use of ICT for design and communications graphics)

3. Practical Guidance and ICT within Subjects

Practical guidance will consist of a range of support material for teachers including general guidance for ICT use; exemplars of best practice highlighting the use of ICT across subjects and embedded support for ICT during the curriculum development process.

General guidance on the integration of ICT in the Primary School Curriculum has already been developed in the publication *Information and Communications Technology (ICT) in the Primary School Curriculum: Guidelines for Teachers*. This includes emphasis on a whole school approach to planning for ICT in the curriculum. Support for implementation is being co-ordinated through liaison with the NCTE and with the support services, PCSP and SDPS already working in schools. This support will be incorporated in in-service courses organised through the NCTE, and in the NCTE ICT seminars for principals.

The role of ICT in curriculum and assessment was a key focus of the first year of the Primary Curriculum Review. As part of the Teacher Template Study (which comprised one activity within the review) teachers were asked to reflect and report on their use of ICT to support the curriculum in English, Visual Arts, and Mathematics. Teachers were also asked to identify any factors limiting their use of ICT in the curriculum. This information will be vital to the NCCA in continuing to support teachers' expressed needs in their use of ICT in the Primary School Curriculum. This guidance, currently under development will include a range of illustrative exemplars of cross curricular and subject specific use of ICT. The exemplars, snapshots of real classroom practice, are currently being developed in a range of school settings across the country and will serve as models of good practice for teachers. These exemplars will be linked to the learning experiences in the Framework and to the strands of the Primary School Curriculum.

At post-primary level *General ICT Guidelines for Post-Primary Schools* are being developed. Similar to the Primary guidance already developed, the purposes of the post-primary guidelines are to

i Promote the use of ICT as a teaching and learning resource throughout the post-primary curriculum.
ii Support the mediation of the ICT Curriculum Framework
iii Support teachers in their work inside and outside the classroom.
iv Provide teachers with ideas, exemplars, resources and strategies for using ICT to support, enhance and transform teaching and learning in their subject areas.
v Assist schools with planning the integration of ICT across the curriculum utilising the ICT Curriculum Framework.
vi Provide guidance and strategies to ensure that students acquire the knowledge, skills, and attitudes necessary to participate fully in the information society. That is, to enable students become ICT literate.
vii Signal future/current directions and developments on the role of ICT in curriculum and assessment.
viii To signal developments on the role of ICT within specific subjects and programmes direct teachers towards the relevant syllabi and guideline documents.

In addition, the role of ICT in curriculum and assessment arises within the ongoing reviews that are taking place in respect of both junior and senior cycle education. At junior cycle, the rebalancing of syllabuses to a common template provides an opportunity for identifying ways

in which ICT can enhance the teaching and learning in a variety of subjects. In the proposed developments at senior cycle, ICT can be used to facilitate and support a more self-directed approach to learning. At both levels, subject syllabuses and associated guidance continue to be 'ICT proofed', establishing the role of ICT as a teaching and learning tool; as an integral part of the curriculum (e.g. painting, design, animation and image editing software in art), and as an integral part of assessment (e.g. CAD in Design and Communications Graphics).

The role of ICT in the preparation and presentation of coursework for assessment purposes (second assessment components) is also being investigated. It is envisaged that, in time, short courses and transition units pertaining to ICT will be developed and the role of ICT as a vehicle for the development of skills will be investigated. The development of an ICT Curriculum Framework provides opportunities for the assessment of ICT at post-primary level. The possibility of students developing a cross-curricular portfolio of work, prepared and presented using ICT, in a range of subject areas for both classwork and coursework and resubmitting these items of work in the context of assessment of ICT is currently under discussion.

Research

Central to and key to the success of these three strands of ICT work, is the need to relate what is already known about current and exemplary use of ICT by teachers and students to the development and dissemination of models of good practice for teachers. The classroom is the fundamental arena for curriculum change, as it is the bridge between what is known about what is possible and worthwhile and teachers' current practice. In order to take full advantage of the opportunities afforded by ICT in teaching and learning, a key leverage for change will be the support provided for teachers to develop competence and confidence with ICT. They will need to see value in terms of enjoyment, ease of use and benefit before they adopt what can be a difficult and time consuming process. When teachers perceive the benefits to their own work from using ICT, they are motivated to change existing practice and use it in the classroom.

Consequently, ongoing comprehensive research is a vital component of the work to inform, support, and test the validity of the model framework, and to develop models of good practice for dissemination and implementation.

The research basis for the NCCA's work will include:

1. Reviews of curriculum at Primary, Junior Cycle and Senior cycle education, to ascertain a clear picture of the current status of ICT.
2. Desktop studies of policy and practice in other jurisdictions and commissioned qualitative research on current practice in the use of ICT in Irish schools. For example, the exploration of the professional development needs of teachers as adult learners with ICT, and the potential of alternative models of teacher professional development to meet teachers' needs.
3. Engagement with policy makers and practitioners in Ireland and in other jurisdictions through conferences, seminars, visits and online communication. (e.g. CIDREE[52], Leargas, ENIS[53] etc)

[52] CIDREE - Consortium of Institutions for Development and Research in Education in Europe

4. The establishment and cultivation of the school as a research site, e.g., identifying a number of Primary and post primary schools as ENIS Schools which will
    - trial and exemplify models of good practice to inform the work of the NCCA
    - act as 'bottom up' sites for developments in curriculum and assessment using ICT
    - pilot, review and inform the development of NCCA curriculum and guidance materials, e.g. ICT Curriculum Framework and the exemplars
5. Focused research projects involving the use of ICT in supporting and enhancing curriculum and assessment. e.g. NCCA/NCTE CAD[54] research project.

The information-gathering strategies outlined above will necessitate collaborations with many partners in education including the DES, NCTE, SEC, schools, teachers, students, parents, other curriculum bodies, Ministries of Education, other agencies etc.

As mentioned earlier a key area of the work for the NCCA will be identifying exemplary models of support which enable teachers to incorporate ICT into their everyday classroom practice. Ultimately, teachers' use of ICT aims to augment (access to) learning for all students, including students with Special Educational Needs, and entails significant planning by individual teachers and collective school staffs. The development of such guidance and models of practice alone will not be sufficient to institute change in the absence of supportive structures.

To this end, other supporting strategies must be planned for and put in place both at a practical level, to support the NCCA in advising the minister in its remit on teacher professional development. Necessary resources to support the work of the NCCA will include funding for personnel, professional development, ongoing research and development, publications and ICT infrastructure.

The forthcoming government policy on ICT in Schools should take cognisance of the work programme of the NCCA through supporting and implementing the necessary infrastructure and professional development of teachers. Ongoing investment is required at school level for infrastructure, technical support, co-ordination and planning time and teacher professional development in a whole school and subject specific context. Accredited paths for teacher professional development and technological resources for teachers should be given serious consideration. The development of online content and curriculum resources to support the unique nature of the Irish Curriculum is an imperative.

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[53] ENIS – European Network of Innovative Schools, A European Commission SchoolNet initiative focusing on innovative schools in the area of ICT in education

[54] CAD Research Project – An NCCA/NCTE collaborative research project comparing 3D Parametric Modelling software for the purpose of informing the implementation of the revised and new technology subjects in the Leaving Certificate

7. Concluding Remarks

This discussion paper on *Curriculum, Assessment, and ICT in the Irish Context* has been developed to increase our understanding of the potential of ICT to support, enrich, extend, and ultimately transform curriculum and assessment in primary and post-primary schools.

We began by acknowledging the challenges of what is referred to as the 'information society/knowledge society/digital age/21st century' and in response, presented our vision for ICT in curriculum and assessment. ICT literacy for all students is at the core of this vision. This vision is premised on the value of enabling our students to become capable independent learners, with the ability to communicate effectively, work collaboratively, and critically evaluate manage and use information.

Placing this vision of the student at the centre of the teaching and learning process, we identified broad inclusive principles of learning with ICT in section 4, and explicated these in real terms, using vignettes of current practice. To further support our vision of ICT literacy for all students, we presented a triadic approach to *learning about, with, and through* ICT. While these principles and approaches have enabled us to calibrate our vision, they do not provide sufficient support for teachers in operationalising this vision across primary and post-primary schools.

The *Framework for ICT in Curriculum and Assessment*, currently being developed (outlined in section 6) will be the key to achieving this vision of ICT literacy for all students. Four learning domains are identified in the *Framework for ICT in Curriculum and Assessment*;

- Communicating, expressing creativity, enquiring and problem solving
- Using ICT productivity and communication tools
- Developing operational knowledge and concepts
- Developing critical awareness of the personal and societal impact of ICT

The dimensions of these learning domains are currently being developed according to four levels, for students in primary and post primary schools.

This vision for ICT in Curriculum and Assessment, must be envisaged in the context of the NCCA's ongoing curriculum development and review. The NCCA is currently engaged in ongoing curriculum review at primary and post primary. These reviews offer valuable insight into current practice in classrooms in relation to ICT, and the opportunities that exist for teachers to engage with the kinds of teaching and learning envisaged in this document.

The potential of ICT to support and re-envisage the curriculum in specific subject areas and disciplines is already evident, for example, in the revised Technology Subjects at Leaving Certificate level, particularly Design and Communication Graphics (formerly Technical Graphics) where ICT is an integral part of both the curriculum and the assessment. In the recently approved Art Syllabus at senior cycle, the use of ICT is promoted in research, planning, design, and creativity.

To ensure equity of participation in an ICT-enhanced curriculum by all students, the potential of ICT to support to support teaching and learning across *all* curriculum subjects must be explored. Many schools have already begun to harness the potential of ICT to support the inclusion of all learners' across curriculum subjects. ICT can afford curriculum access to

students with disabilities in ways that were not previously possible. ICT enabled curriculum differentiation offers alternative approaches to learning such as self regulated, self paced and self directed learning, as well as interaction with communities of learners outside the school.

As we continue to develop the NCCA work programme, with this vision for ICT at its core, we have identified two issues. Both pertain specifically to the design and use of the ICT framework. These issues concern planning for the framework and recognising achievement within the framework.

Planning
Schools will require support in harnessing the potential of ICT to support learning in specific subject areas, including the development of higher order thinking skills, experiential learning, collaborative learning and the differentiation of learning for students with different needs. Schools will require support in planning for the framework across the curriculum.

Through our enabling structures of Council, we have identified a key question concerning planning for ICT in curriculum and assessment:

- *What form of advice/guidance/support can the NCCA offer to assist schools in planning to apply the framework across subjects?*

Recognising achievement
Embedding ICT in assessment will be an important requirement for its take-up in curricula. A number of possibilities in relation to ICT in assessment were presented in Section 5, e.g. . Electronic portfolio assessment which involves assessing ICT through a cross curricular portfolio of work exhibiting the acquisition and application of ICT skills. This approach to demonstrating achievement, seems particularly relevant to the ICT Framework. Electronic portfolios are used to increase the involvement of the learner in the assessment process.

The question of validating and accrediting ICT capability is currently receiving attention in other jurisdictions, for example, the Junior Pupils ICT Licence being introduced in Denmark[55]. Through our enabling structures of Council we have identified two questions concerning recognition of achievement within the ICT Framework.

- *We have articulated levels of achievement within the Framework. What strategies do we want to promote for monitoring of students' learning and progress in reaching these levels?*
- *How can we recognise student achievement of learning outcomes at a particular level within the framework?*

Generative discussion of these questions has focused on the critical role of the teacher in achieving this vision of ICT in Curriculum and Assessment for all students. As gatekeepers of students' learning teachers have a vital role to play in furthering students' development of ICT knowledge, skills and attitudes and in striving for equality of learning opportunities for students.

[55]See http://www.junior-pc-korekort.dk/pdf_download/Pupils%20ICK%20Licence_information.pdf

Access by all teachers, regardless of location and subject specialism, to high quality initial and ongoing professional development in ICT pedagogy will be a prerequisite to the fulfilment of this vision. The ongoing professional development of teachers in ICT skills and ICT pedagogy will be lynch pins in achieving the developments in ICT in teaching and learning outlined here. Change is nevertheless a complex process and requires more than training in new process or method. Such changes in pedagogy require targeted supports at the practice level of the teacher in the classroom. Resources and software appropriate to the curriculum and to educational use will be key in both encouraging the increased use of ICT in classrooms, and more importantly in supporting the kinds of valuable learning experiences that are envisaged.

Access to the artefacts or the objects of the change – in the form of high-spec ICT equipment and resources, will be critical for teachers in realising the potential of ICT to truly enhance teaching and learning. The state of the ICT infrastructure in schools (outlined in section one) in terms of hardware, software, networks, communication, and technical support is key to achieving the kinds of learning outlined in this document and recommended in the NCCA Work Programme. Pupil/computer ratio of 5 or 6:1 along with a range of other digital devices is not only the aim, but is already the increasing reality in many other jurisdictions.

There is a need for a co-ordinated balanced approach to achieving the vision of *ICT literacy* for ***all*** students.

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