



Leadership in Information and Communications Technology



SMART **SCHOOLS** = SMART **ECONOMY**

Report of the ICT in Schools Joint Advisory Group to the Minister for Education and Science

Membership of the ICT in Schools Advisory Group

Paul Rellis (Chairman), **Microsoft**

Mary McGarry, **Department of Education and Science**

Mary Kirk, **Department of Education and Science**

John Dolan, **Department of Education and Science**

Deirdre McDonnell, **Department of Education and Science**

Derek Byrne, **Department of Communications, Energy and Natural Resources**

Jerome Morrissey, **National Centre for Technology in Education**

Martin Cullen, **HP**

Kim Majerus, **Cisco Systems**

Adam Grennan, **Cisco Systems**

Dermot O'Connell, **Dell**

Kevin Marshall, **Microsoft**

Greg Tierney, **Steljes**

William McAuliffe, **BT**

Barry O'Brien, **IBM**

Paul O'Riordan, **Oracle**

Colin MacHale, **Intel**

Paul Sweetman, **IBEC, ICT Ireland**

Kathryn D'Arcy, **IBEC, ICT Ireland**

Aoife O'Brien, **IBEC, ICT Ireland**

The wider ICT Ireland membership was also consulted and gave generously of their time throughout the development of this report.

Acknowledgements

In the course of developing this report, the ICT in Schools Advisory Group consulted with a wide variety of individuals and organisations. The ICT in Schools Advisory Group would like to thank everyone who provided input to the study: the working group members for their contribution to the development of the recommendations and strategic policy requirements; and the wider ICT Ireland membership who provided insights and a wide perspective on the global and national trends that have the potential to shape the future we and our children will live in.

The opinions expressed in this report belong to ICT Ireland and do not necessarily represent the views of any individual or organisation that participated in the work.

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1. Executive summary

Ireland's national recovery will be rooted in further developing our outstanding education system. Schools and colleges are key contributors to economic growth and national competitiveness, providing successive generations with the skills and abilities necessary for a vibrant economy and inclusive society. Within the educational system, teachers play a central role in developing the potential of our children and young people. Our education system must continue to be responsive to and supportive of the economic life of this country.

We are currently facing new and difficult challenges which, coupled with the need to establish Ireland as a smart economy, will require our education system to continue to adapt and adjust to the changed circumstances. The convergence of information and communications technologies (ICT) is having the most profound impact on our society and economy. How it will evolve and continue to impact on our lives and our children is an open question. What is clear is that when such technologies are deployed in schools, they are being embraced enthusiastically by teachers and students globally. The efficacy of ICT in enhancing the learning experience is being proven both in the classroom and at home. To ensure that Ireland keeps pace with global technological developments and to truly support every child's development potential, an urgent strategic initiative is required.

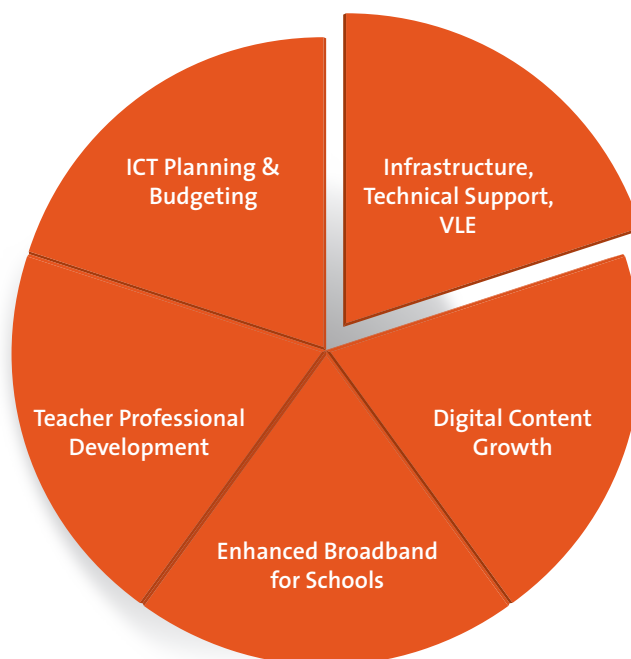
The "Investing Effectively in ICT in Schools" report of 2008 established a credible baseline for ICT investment in schools over a seven year period. The Advisory Group recommends that an initial investment package of €150 million be committed immediately to address the infrastructural deficit in schools' basic technology systems to provide teaching-computers coupled with educational software and digital projection. If deployed over the coming three years, this investment will substantially close the current infrastructure gap, and should then be followed with an annual budget in the region of €30m for support, rolling replacement and enhancement of the service. The Advisory Group has developed a series of recommendations that establishes a frame-

work for the ICT investment decisions and activities that are needed to have an enduring and sustainable impact in school classrooms. In establishing these recommendations, five core areas were examined (Figure 1), namely:

1. Classroom and student infrastructure, technical support and the virtual learning environment (VLE);
2. Teacher Professional Development;
3. ICT planning and multi-annual budgeting;
4. Digital content growth;
5. Enhanced broadband for schools.

The recommendations, described in detail throughout the report, should be delivered in parallel over the period from 2009 to 2012. Crucially, these recommendations are predicated on having the multi-year budgetary plan in place and a procurement strategy based on a new, centralised model. Only through strategic commitment and coordinated investment, will our goal to develop a digital learning environment be attained.

Figure 1: Core areas examined in developing recommendations



The key to this initiative's success will be timely implementation and execution of the recommendations outlined. Therefore, the Advisory Group calls for the establishment of an ICT in Schools Steering Group, drawn from key stakeholders (government departments, industry, schools, teachers and parents). The Implementation Steering Group, will report directly to the Minister for Education and Science will have responsibility for:

1. Overseeing the ongoing successful implementation of the programme;
2. Providing advice on future policy directions, taking account of technology developments and future trends, and advising on the organisational approach to integrating ICT into teaching and learning;
3. Acting as a forum to foster the sharing of best practice in, and innovative approaches to, integrating ICT into teaching and learning;
4. Facilitating the partnership of industry and education at schools, both at regional and national levels, in pursuing the common goal of integrating ICT into teaching and learning.

The ICT industry remains committed to playing its role in developing the smart economy, in partnership with Government, and to mutually striving to help Ireland regain its competitiveness and national prosperity, through a prudent technology-investment strategy in our schools.

2. The vision for digital learning

The Advisory Group's vision is that Ireland will have an education system that equips our young people with the critical skills to play an active role in the 21st century's economy. In addition to the foundation skills of literacy and numeracy, the Advisory Group believes that the following skills will be essential for active, social and productive participation in the knowledge-based social and economic environment:

- Knowing how to access and critically analyse information;
- Easy familiarity with ICT and its creative productive use;
- Ability to apply knowledge to new and evolving situations;
- Being adept at cross-disciplinary work, collaborating and communicating;
- Showing self-initiative, applying creativity and inventiveness in the working environment;
- Being skilled at problem-solving and decision-making;
- Being able to work independently and in teams;
- Being confident in leadership roles;
- Developing entrepreneurial skills;
- Committing to life-long learning.

These skills are reflected in the document *European Reference Framework on Key Competences for Lifelong Learning*, which included digital competence, defined as the:

confident and critical use of Information Society Technology for work, leisure and communication. It is underpinned by basic skills in ICT; the use of computers to retrieve, assess, store, produce and exchange information, and to communicate and participate in collaborative networks via the internet ¹.

The Advisory Group's view is that this vision cannot be achieved without the holistic integration of ICT directly within the curriculum and assessment procedures. Taking full advantage of the benefits of ICT in teaching and learning will encourage and enable all students to become self-assured and self-directed learners. These are abilities which students will need and value throughout their lives.

The enabling drivers for a digital learning environment are:

- An educational technology vision that is led from the top (ie, Department of Education and Science), but owned and effectively managed throughout the system, whereby school-based innovation in the use of ICT is financed, assisted and encouraged;
- A high standard of reliable technology that is deployed effectively in all primary and post-primary schools;
- A rich source of digital content that supports the curriculum at primary and post-primary levels;
- Digitally-literate teachers.

¹ Recommendation of the European Parliament and of the Council of 18 December 2006, on key competencies for lifelong learning (2006/962/EC) OJ L394/10 30.12.2006.

A digital learning environment will:

- Encourage students to undertake challenging and stimulating learning activities, supported by access to global learning resources and powerful tools for research, information processing, communication and productive work;
- Support teachers to devise, manage and direct student centric learning activities which address the curriculum objectives by providing enriched opportunities for collaborative learning;
- Facilitate more personalised learning activities;
- Provide opportunities for the eventual incorporation of student digital devices in school work;
- Allow both teachers and students to exploit web 2.0 potential, so that they can write, publish and share digital learning content;
- Facilitate greater contact and collaboration, both among schools, teachers and students, and between schools and business;
- Allow, through video conferencing, social and cultural exchange among students both within Ireland and overseas;
- Lead to up-to-date ICT based professional development of teachers;
- Assist parents to support students in their digital learning and to communicate with schools online.

3. Review of the current use of ICT in schools

The European Commission's 2006 survey on the use of computers and the internet in European schools² found that all Irish schools use computers for teaching and that 82% of Irish teachers had used computers in class in the preceding 12 months, against an EU average of 74%. It found that Irish teachers ranked around the EU average, in terms of positive attitudes about the different applications for ICT in teaching.

Irish teachers who used computers in class “rank top in Europe” and feel very confident using email (73% as compared to 66% EU average), and using text processors (58% as compared to an EU average of 65%). However, Irish teachers feel less confident downloading/installing software and creating electronic presentations. The survey also found that 91% of teachers strongly agreed that pupils were more motivated and attentive when computers were used in class.

However, the survey also highlighted the challenges that remain to improve further ICT infrastructure in schools. The survey used a model of ICT readiness of teachers which assessed teachers’:

- Access (including their satisfaction therewith) to computers and the internet at school;
- Competence in using computer software and applying them for teaching purposes; and
- Motivation for using ICT, gauged by their attitude that using computers in classrooms results in significant learning benefits.

² European Commission Survey, *Use of Computers and the Internet in Schools in Europe 2006, Country Brief: Ireland, 2006.*

It was concluded that Ireland ranked 19th of the 25 European countries, via this model, with 30% of teachers being “ICT ready”. The survey stated that:

Despite the fact that all Irish schools are equipped with some computers and have an internet access, a major problem seems to be the still insufficient ICT equipment and access to the internet in Irish schools, indicated by 34%. As a consequence, Ireland finds itself in the bottom half of European countries on the ICT readiness of schools and teachers.

The National Centre for Technology in Education (NCTE) 2005 census³ found that the pupil-computer ratio was 9:1 in primary schools and 7:1 in post-primary schools, quite some distance from the desired ratio of 5:1. The census found that about 44% of computers in primary schools were located in classrooms, 27% were in computer rooms and 10% were mobile. There was an average of 1.3 computers per primary classroom and 8.5% of primary classrooms did not contain any computers. In addition, the evaluation report undertaken by the Department of Education and Science’s Inspectorate *ICT in Schools* (2008), noted that computer rooms are more commonly found in larger primary schools, and that access to computers by pupils was superior where computers were located in classrooms⁴. In post-primary schools, only 4% of computers were located in general classrooms and 58% in computer rooms⁵.

Taken together, these figures suggest that teachers in a “typical” school are unlikely to be able to use computers in the classroom for group instruction (on the basis of 1.3 computers per classroom on average), while some teachers may not be in a position to use computers in their classrooms at all. Not surprisingly, the inspectorate evaluation found that where schools made dedicated computer facilities available to teachers, it led to the use of more high-quality and creative teaching resources in classrooms.

3 *The NCTE 2005 Census on ICT Infrastructure in Schools*, publication provides the most recent information and analysis on ICT infrastructure relating to primary, post-primary and special schools in Ireland

4 *ICT in Schools* is the report of a major evaluation undertaken by the Inspectorate of the Department of Education and Science. It reports on the extent to which ICT is used in primary and post-primary schools, and on the impact that the use of ICT has had on supporting and improving teaching and learning.

5 The remaining 19% in primary schools and 38% in post-primary schools were located in other specialist classrooms, laboratories, offices etc.

The 2005 *NCTE Census* results also indicate that over 28% and 19% of computers in primary and post-primary schools respectively were greater than six years old. This increases the difficulties teachers and students have in attempting to use digital content for teaching and learning.

The OECD's Programme for International Student Assessment (PISA)⁶ study in 2006 contained some questions on computer use in schools. The available findings show that while there has been an increase in the use of computers in Irish schools in the "at least once or twice a week by 15 year olds" category (47% in 2006 as compared to 24% in 2003), Irish students are still behind the OECD average of 55%. Of perhaps greater concern highlighted by the PISA report is that 30% of students reported never using computers in schools, as compared with an OECD average of 13%.

The conclusion of the Joint Advisory Group is that some progress has been made in putting basic ICT infrastructure in place in Irish schools and in the provision of teacher professional development and online learning resources. However, there is now an urgent need to prioritise ICT investment in schools. This will ensure that the ICT enabled educational experience of our children is reflective of the twenty-first century and that Ireland can achieve the vision set out in chapter 2 of this report.

⁶ PISA – OECD Programme for International Student Assessment 2006 – material contained in the submission on behalf of the Department of Education and Science to the Joint Oireachtas Committee on Education and Science, 26 March 2009.

4. National economic and social imperative

In *Building Ireland's Smart Economy*⁷, the Government sets out its vision to develop an economy with a thriving enterprise sector, high-quality employment, secure energy supplies, an attractive environment and first-class infrastructure. The objective, according to the Government is to “make Ireland an innovation and commercialisation hub in Europe”.

The smart economy will be built on a culture of collaboration, creativity and entrepreneurship. Our educational system has a pivotal role to play in nurturing these characteristics in our young people. Many countries, including Asian and Eastern European countries, have already launched national skills development programmes, and are building a competitive advantage. However, based on the quality of our school system and with renewed focus and investment in the development of a digital learning environment, Ireland can foster the key skills for a competitive knowledge-based economy. We have the ability to truly become a hub for the global knowledge-based economy, supporting and growing Irish and foreign-owned companies.

Emerging studies indicate a correlation between economic development and ICT penetration and integration in our education systems and society. The recently published *Forfás Statement on Education and Training* (March 2009), by the National Competitiveness Council (NCC)⁸, supports this view by stating that:

The use of information and communications technology (ICT) is reshaping how we work and live. Ireland's ability to maximise the benefits of ICT and to remain a leading provider of ICT goods and services is dependent on ICT literacy levels. Ireland's future competitive advantages are likely to be in internationally trading sectors (e.g. software, high-technology manu-

⁷ *The Building Ireland's Smart Economy* document sets out an ambitious set of actions to reorganise the economy over the next five years and to secure the prosperity of current and future generations.

⁸ *Forfás Statement on Education and Training* by the National Competitiveness Council (NCC), outlines priority recommendations to enhance Ireland's education and training system.

facturing, financial services, and other business services) that depend on advanced telecommunications infrastructure and an ICT-literate population. ICT has the potential to enliven learning in science, engineering and technology subjects, which underpin the skills on which future competitiveness will be based.

The critical importance of ICT to a knowledge economy is reiterated in the recently published *Technology Actions to Support the Smart Economy*⁹. This action plan aims to position Ireland at the forefront of the digital and clean technology revolution, and create 30,000 jobs over the next 10 years. The availability of a digitally-literate workforce underpins the realisation of these ambitious targets.

Ireland, in common with a number of other developed countries, is suffering from a fall in interest in Science Technology Engineering and Maths (STEM) subjects at post-primary and third level. ICT Ireland believes that a decisive investment in ICT in schools will support the teaching and learning of STEM subjects at primary and post-primary level, and will bring new digital content tools, which enliven and enrich the learning of these subjects. While the arts, languages and other areas of the curriculum can flourish through better use of technology, the STEM subjects are particularly suited to the use of technology and related interactive content. Conversely, failing to invest in ICT in schools will mean that the take-up of STEM-related subjects at second and third level will most likely continue to trend downwards. Over time this decline will exacerbate the challenges to realising the smart economy goal and threaten the existing knowledge-based businesses in Ireland which depend on a workforce which is skilled in key technology-related subjects, such as maths and science.

Access to the use of technology in all schools will also help to address the digital divide which exists in Ireland, so that all young people can enjoy the same opportunities afforded by technology, regardless of regional location or socio-economic grouping. Data from the OECD report, *Are Students Ready for a Technology Rich World? What PISA tells*

⁹ *Technology Actions to Support the Smart Economy* is the first report in the *Knowledge Society Strategy* process. This process will produce a broader report in 2010, covering the wider social and economic developments that will be needed to progress a knowledge society in Ireland.

us? (2005)¹⁰, shows that economic background is a strong predictor of whether a student has access to a computer at home. Students from the least privileged backgrounds are significantly less likely to have a computer available at home than those from the most privileged backgrounds.

Therefore, school access to computers is especially important for disadvantaged students. While the *NCTE 2005 Census* showed that the pupil-computer ratio was marginally better in disadvantaged schools (7.4:1 and 6.1:1 in primary and post-primary respectively) than in non-disadvantaged schools (9.4:1 and 7.4:1 in primary and post-primary respectively), the computers in disadvantaged schools were considerably older than in non-disadvantaged schools. Furthermore, the ability of schools generally to access financial support from their parents and local communities is weakened during economic downturns. This pressure will be felt more acutely by disadvantaged schools. The report of the Minister for Education and Science's Strategy Group, *Investing Effectively in ICT in Schools*¹¹, put it best when stating, "expansive and strategic investment in ICT in education is an investment in all our futures and must now become a reality for Ireland".

¹⁰ The new OECD report *Are students ready for a technology-rich world?* provides first internationally comparative data on: the opportunities 15-year-old students have for using computers at home and at school; how they use computers and their attitudes to them; the relationship between computer use and performance in key school subjects.

¹¹ A strategy group was appointed by the then Minister for Education and Science, Ms Mary Hanafin TD in 2007, to advise on the priorities for investment in ICT in schools. The report is available on the Department of Education and Science website – www.education.ie

5. Priorities for future ICT development in schools

Implementation

The Advisory Group notes the initial steps being taken to implement the Strategy Group report, *Investing Effectively in ICT in Schools*¹² since its publication in 2008. However, the Advisory Group believes that it is imperative to immediately implement a sustained investment plan over three years to provide the essential ICT infrastructure in schools. The recommendations of the Strategy Group report must be delivered in tandem with the recommendations of this Advisory Group's report.

Governance

The success of the ICT in Schools Strategy is dependent on a shared commitment by all the educational partners, encompassing individual teachers, school management, teacher unions and management bodies, the Department and its agencies, industry, students and parents. We support the recommendation of the Strategy Group for the re-establishment of a consultative and representative forum for education and industry partners. **Specifically, we recommend the establishment of an ICT in Schools Steering Group to oversee the implementation of the recommendations in this report.**

The Implementation Steering Group will have responsibility for:

- Overseeing the ongoing successful implementation of the recommendations within this report;
- Providing advice on future policy directions, taking account of technology developments and future trends and will advise on the organisational approach to integrating ICT into teaching and learning;

¹² *Investing Effectively in Information and Communications Technology in Schools 2008-2013* is the report of the Strategy Group appointed by the Minister of Education and Science, to advise on the priorities for investment in ICT in schools; having regard to the critical success factors for successful integration of ICT into learning and teaching.

- Acting as a forum to foster the sharing of best practice in, and innovative approaches to, integrating ICT into teaching and learning;
- Facilitating the partnership of industry and education at schools – both at regional and national levels – in pursuing the common goal of integrating ICT into teaching and learning.

The members of the group should be drawn from key stakeholders (Government departments, industry, schools, teachers, students and parents) and will report to the Minister for Education and Science.

Professional development for teachers

Teacher professional development is fundamental to the successful integration of ICT in schools. According to the report to the Minister for Education and Science on *Investing Effectively in ICT in Schools*, initiatives in The Netherlands, Finland, Northern Ireland and other countries indicate that appropriate professional development and support for teachers in tandem with teachers' personal motivation are key factors in progressing ICT integration. It is crucial that teachers are given opportunities to pursue targeted professional development to assist them to embed the use of ICT in teaching and learning.

It is the view of the Advisory Group that teacher professional development (both at pre-service and in-service) should, therefore, be at the very core of an investment plan for ICT integration in schools.

The Advisory Group recommends that the Teaching Council focus on the ICT professional development needs of teachers in the development of its Strategy for the Review and Accreditation of initial teacher training programmes.

The Advisory Group supports the integration of ICT into all teacher professional development programmes, and recommends that this integration be realised as quickly as possible.

The Group advocates the expansion of the range of options available for teachers to upskill on the use of ICT in teaching and learning and for related ICT training. We support the Strategy Group recommendation for more on-line and whole school training. Industry currently develops and supports some teacher professional development (see Appendix 2 for some examples). **The Advisory Group recommends that where viable, industry makes available professional development opportunities for teachers and that these opportunities be promoted via a central resource. Industry should also make available, where relevant and feasible, in-company training for use by teachers.**

The Advisory Group recommends that the potential to formally recognise teachers reaching certain standards in ICT-related courses be explored in consultation with the Teaching Council. It is further recommended that the present arrangements for credit accumulation for completed NCTE qualifications in ICT studies be enhanced and expanded.

The Advisory Group notes the provision of workshops for ICT co-ordinating teachers in post-primary schools late last year and the **Advisory Group recommends that similar workshops be provided for the primary school ICT co-ordinating teachers. It supports the emphasis being placed on e-planning at school level and recommends that an ICT Ireland/NCTE co-ordinated mentoring programme be established where the ICT industry would act as mentors to ICT co-ordinators.** This programme could also support the sharing of best-practice in the use of teaching and learning digital content and equipment.

Availability of digital content

Innovative, high-quality and Irish curriculum-related digital teaching and learning resources must be made available to teachers and students at primary and post-primary levels. This is a core principle in the successful integration of ICT in schools.

The availability of and access to digital content are cornerstones of a successful digital learning environment. Learning-related digital content can take several forms: content created by publishing companies and purchased for use in schools; learning content

developed by the national education portal site, ie, *Scoilnet*¹³; content created by and shared among teachers and students; more general content sourced from the internet. Digital content has long since moved on from simple text and image files. What is driving widespread usage today is media-rich content that combines audio and video to create highly engaging and vivid learning experiences for students of all ages. **In this regard, a significant expansion and enrichment of Scoilnet as a key portal site for learning content for schools is recommended.**

Teachers and students should have access to high-quality, curriculum-relevant, locally and globally generated software and digital educational content. **The Advisory Group recommends that the NCTE, the technology sector and the education publishers explore the development of world class digital educational content.**

The Advisory Group also recommends an increased focus on the creation of digital content for students with special educational needs. As has been advocated in the Inspectorate's Evaluation ICT in Schools, schools should exploit more fully the potential of ICT to support the learning needs of students with special educational needs.

Both private and public organisations have a wealth of digital archives and content which could be used to support the Irish curriculum. **The Advisory Group recommends that the NCTE should work with these organisations to make such content available for use in education.** Recognising the current constraints limiting the NCTE's ability to address the range of actions being prioritised, the Advisory Group recommends that the potential to use a work placement programme be examined. This would allow unemployed ICT and teaching graduates to work in industry with the goal of developing digital educational content in consultation with the NCTE.

The Advisory Group also recommends that a national learning environment be built and made available to schools and teachers. This network, also referred to as a virtual learning environment (VLE), would provide opportunities for schools to develop online resources and facilitate online administrative functions. Integrated with the school

portal site, a VLE will facilitate the building and sharing of digital content at school level, coupled with home access to learning resources and home/school communication. A VLE facilitates teachers' and students' participation and collaboration in communities to share and contribute to the creation of learning resources and to take advantage of web 2.0 functionality.

Enhancement of broadband connectivity

Given that the availability of digital content for learning is advancing quickly, the tools to access content must keep pace in terms of their efficacy and capacity. Apart from the availability of teaching and learning computers themselves, the other constraining resource for accessing content is the connectivity environment in schools. The Broadband for Schools Programme Phase I addressed this issue on a national basis starting in 2005. It is well recognised that some of the access technology services struggled to match growth requirements, performance and reliability expectations. The Phase II Programme is expected to resolve many of the shortcomings in Phase I, when fully implemented in early 2010.

The improvements in service that will be garnered by Phase II are very much welcome. However, the evidence suggests that bandwidth requirements are doubling every 18 months. The connectivity solutions for schools must be in step with the digital evolution gathering pace globally to safeguard the educational value and consequences at stake here.

The proposed 100Mbps connectivity for post-primary schools is a bold policy response by the Government, and the Advisory Group welcomes this innovative and far-sighted approach. It will cater for the increasing demands of teachers and students to harness new sources of learning and to support project work that embraces a variety of media sources. The Advisory Group welcomes the announcement of the 78 post-primary schools to participate in the 100Mbps connectivity demonstration project, announced by the Minister for Communications, Energy and Natural Resources. This project will facilitate the immersive use of ICT in schools, such as the incorporation of student devices in their daily school work.

The Advisory Group endorses the ICT Strategy Group's view that the provision of broadband internet connectivity should be regarded as essential national infrastructure and welcomes the management and financial responsibility being taken by the Department of Communications, Energy and Natural Resources in relation to the 100Mbps demonstration project. **The Advisory Group recommends that funding becoming available to the State from the sale of spectrum following Digital Switchover in 2012, be used to realise the introduction of the 100Mbps programme to all post-primary schools.**

Embracing core teaching principles

The Advisory Group endorses the NCCA's ICT framework, *A Structured Approach to ICT in Curriculum and Assessment*¹⁴ as an enabling framework for teachers to embed ICT in curriculum and assessment. The framework was developed in the belief that ICT can add value to teaching and learning, when it is used purposefully and with appropriate resources. Its objectives are to help teachers to support students in:

- Exploring the potential of ICT to create, communicate, collaborate, organise and produce information;
- Understanding and applying knowledge of the functions of ICT, including safe practice, maintenance and ergonomics;
- Using ICT for thinking and learning, including managing enquiries, assessing information, solving problems and expressing ideas across a range of curriculum areas;
- Developing a critical appreciation of the role of ICT in society and habits, which reflect ethical and responsible use of ICT.

The Advisory Group welcomes the creation of the Action Website (www.action.ncca.ie) and recommends the expansion of the website to provide sample activities for all areas and levels of the framework. The potential to use a work placement programme for unemployed graduates to realise this recommendation should be explored.

¹⁴ The ICT Framework *A Structured Approach to ICT in Curriculum and Assessment* offers schools a structured approach to using ICT in curriculum and assessment by identifying the types of learning with ICT (including knowledge, skills and attitudes) appropriate for students during the period of compulsory education.

Implementing sound technology principles

Almost all schools across Ireland have already deployed a broad variety of ICT infrastructure components, reflecting the reality of technology product choice in the wider world. At the same time, there are advantages in striving for a level of standardisation of the infrastructure in schools, not least to simplify the technical support and ongoing maintenance requirements. However, with new technologies continually becoming available, and acknowledging the differing needs and resources of schools, a diverse technology environment is likely to continue.

The Advisory Group recommends that the Department seeks to reduce the variety of equipment deployed, by centralising the expenditure of the Department's ICT funding and by providing strong guidelines and incentives for the expenditure of schools' own funds. This does not necessarily mean that a single technology choice has to be imposed. For example, through a centralised procurement the Department of Education and Science could offer schools a choice of technology options while still benefiting from significant economies of scale. Schools could retain a level of choice and control while participating in a nationally procured solution.

The detailed specification of the technology to be implemented is a matter for the NCTE, and will, of course, evolve over time. However, **the Advisory Group recommends the following guiding principles for investment in schools' IT infrastructure.** If followed, these principles will help to ensure that schools benefit from an appropriate level of ICT functionality and service, while minimising lifetime costs, including training, software licensing, maintenance and support, energy use, replacement and disposal.

Robust security – online safety is an essential element of the internet connectivity school curriculum. The Advisory Group endorses the policies and support services of the NCTE and the Schools Broadband Network to protect schools from unacceptable network intrusions/threats and the awareness-raising initiatives in schools regarding responsible and safe use of the internet.

Flexible interoperability – data and content developed by teachers and students should be stored in file formats defined by open standards, and only technologies that comply with open standards should, as much as is practicable, be used. The Advisory Group calls for a more explicit policy statement on the promotion and adoption of open standards for ICT infrastructure in schools.

Cost efficiency – the total cost of ownership (TCO) through the lifetime of each product must be considered, including energy and environmental considerations. The Advisory Group recommends that affordability and sustainability be considered as important criteria in any technology procurement decisions.

Support and maintenance – a technical support and maintenance service should be included in the TCO, so that users can be confident the infrastructure will work, thereby allowing them to concentrate on teaching and learning. The Advisory Group recommends that provisions for support and maintenance be considered as important criteria in any technology procurement decisions. In determining the appropriate level of service, there is a trade-off between what might be desirable and what is affordable or practical. This is a matter for the Department to decide, but as a starting point, the Advisory Group proposes that a next-business-day maintenance service would be ideal for most elements of the ICT infrastructure in schools. The most important point is that a service level be established in which teachers can have confidence.

Deployment flexibility – schools should be able to deploy ICT in a manner that best suits their circumstances and needs, within the context of any centralised arrangements.

Continuous reliability – the school ICT infrastructure must be reliable and deliver a consistent and dependable teaching experience without compromising classroom management. The Advisory Group recognises that this will remain a significant challenge until ICT infrastructure becomes a mature and reliable utility service within the classroom. In the interim, the Advisory Group recommends a phased deployment approach that primarily and consistently supports the teachers, while evolving towards an environment that fosters universal student participation over time.

Embedding ICT planning in school management

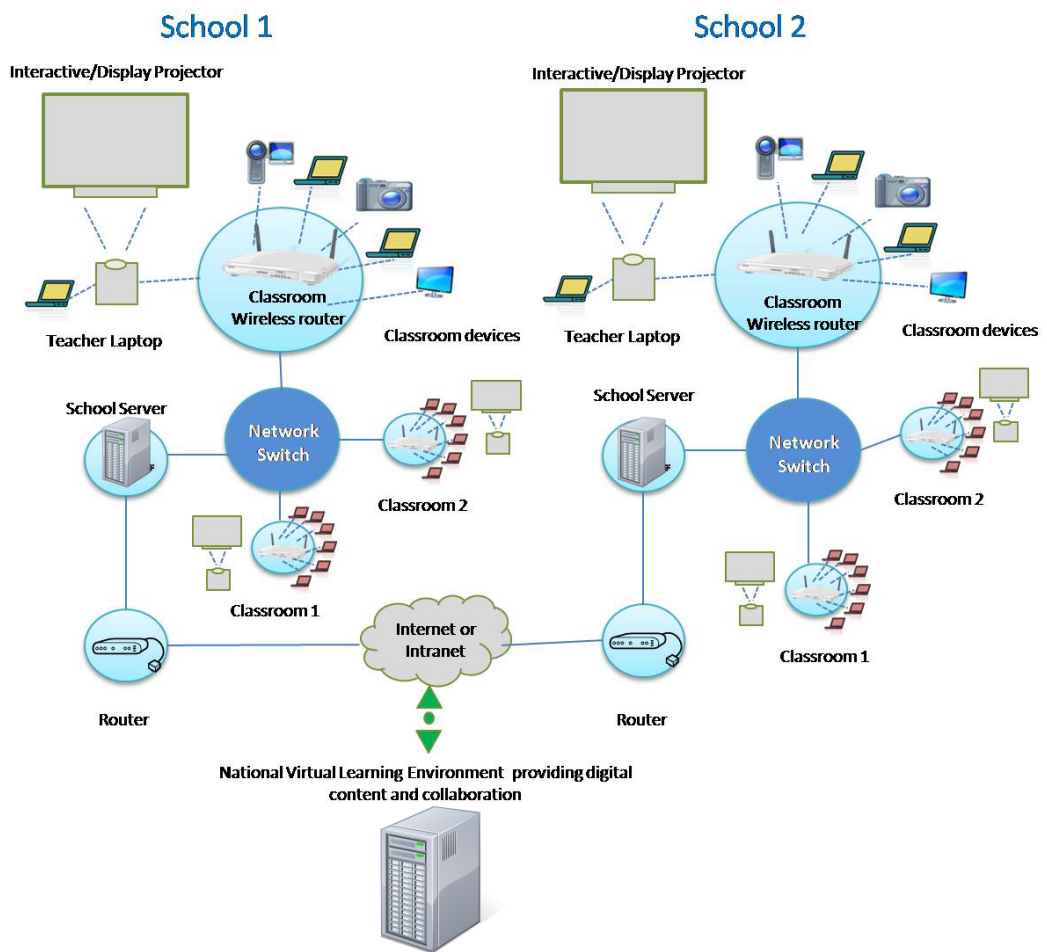
The NCTE is publishing *Planning and Implementing e-learning in your school – a Handbook for Principals and Coordinating Teachers*, together with an e-Learning roadmap, which identifies four different levels of maturity and competence for integrating ICT into schools and classrooms. The roadmap considers the areas of leadership and planning; ICT in the curriculum; professional development and e-Learning culture, as well as the issue of ICT infrastructure. It provides a ready-made tool for school managers and boards to adopt a structured approach to ICT planning and budgeting.

The Advisory Group endorses these initiatives. The Group proposes that the responsibility for planning ICT infrastructure development be a shared and collective one, both within the schools and assisted by the Department of Education and Science and its agencies. By adopting the NCTE roadmap as a diagnostic, it facilitates a common set of terms and definitions for framing an ICT plan and budget for a school over a multi-year horizon, with annual reviews to assess progress and re-focus priorities and funds.

It is vital that ICT planning becomes an intrinsic process for schools and is integrated within overall school plans. The pervasive nature of ICT facilities will quickly demand a high level of attention and precision in the annual planning process. A sporadic approach to ICT planning will undermine teacher and student confidence in the use of ICT and lead to poor usage levels and skills development.

The following diagram outlines a school solution, which will help to explain how a school could operate with full deployment of ICT.

Figure 2 – Schematic of a possible school ICT architecture



The Advisory Group recognises that this vision cannot be realised overnight and that the schematic shown is one of a possible number of school architecture solutions. Therefore, the priorities and timelines for the integration of ICT over an agreed timeframe are outlined in the following section.

Foundations for future ICT infrastructure

Notwithstanding the absolute need for ICT planning in schools, there are obvious minimum and desirable levels of ICT enablement to reinforce the progress made to date, and to accelerate the deployment and adoption of ICT within the classroom.

The professional development of teachers is vital for the success of this initiative and cannot be divorced from ICT infrastructural development. Equally, enhanced broadband connectivity coupled with local area networks are pre-requisites for a digital learning environment. The development and management of digital content is also essential, as is technical support and equipment maintenance. These are requisite foundation services.

The ICT in schools project has the potential to have a significant impact on our education system. To achieve this goal, the following technology requirements – which are the minimum required – must be implemented.

First, the Advisory Group recommends that a teaching computer be deployed in every classroom in 2009/2010, along with a digital projector. The teaching computer will have the facility to access the internet and offer, at least, a basic stack of content-free applications (capable of editing text, graphics and media) together with a range of online content and resources for learning. Different product solutions include Windows, Apple, and Linux-based options, various screen sizes, performance characteristics, and so forth. The teaching computer will be connected to the school's LAN and to the digital projector in order to access and show digital content. This combination is an extremely useful and effective teaching tool that facilitates a range of learning opportunities in whole-class teaching scenarios. Alongside this, devices, such as digital video cameras, visualisers, wireless mouse and keyboards and speakers and printers, should also be considered to further develop the school infrastructure and development of resources.

While it would be ideal to deploy teaching computers and digital projectors in all classrooms with the associated devices recommended for schools simultaneously, the Advisory Group recognises that with constrained funding, a phased introduction may be necessary. The precise costs will be dependent on the market response to the procurement approach taken and the extent to which school classrooms are currently equipped.

Second, the Advisory Group recommends investment in the establishment of a national educational network or virtual learning environment (VLE) in 2010. This is a core set of digital tools and services which provides an online platform to facilitate teacher/student communication, and provides access to dedicated learning resources and enables home/

school liaison. A VLE provides an online mechanism for the development of communities of practice for teachers and facilitates the creation and sharing of learning materials by both teachers and students within and among schools. A national VLE offers the potential to extend learning opportunities and communication beyond the classroom and provides access to a range of educational resources which facilitate more personalised learning. Teacher professional development and administrative services can be delivered very effectively within an online environment.

Third, the Advisory Group proposes that school servers be enhanced, where necessary, and that schools deploy or upgrade LANs to deliver improved security and connectivity, ease of administration and file and print sharing during 2010 and 2011. In order to future proof the deployment of ICT in schools, consideration should be given at the earliest possible stage of planning to allow schools to accommodate a student's own device.

Fourth, the Advisory Group proposes that a minimum of five learning computers be deployed in each classroom over the next three years (2010-2012). The realisation of a 5:1 student to computer ratio would match the leading international norms.

In the longer-term some envisage an individually-tailored education provision with a 1:1 computer to student ratio. Such a scenario may be realised by the accommodation of students' own devices. As with the teaching computers, referred to above, the learning computers in classrooms should include internet access and a basic stack of content-free applications and digital resources for learning. Again, different solutions include Windows, Apple, and Linux-based options, various screen sizes, performance characteristics, traditional/virtualised, and so forth.

There are some 850,000 students in our primary and post-primary schools. Achievement of a 5:1 student to computer ratio implies a reserve of 170,000 computers. The Strategy Group estimated some 50,000 computers being less than six years old in 2007. Assuming that 10,000 computers are disposed of every year, the current supply of computers less than six years old could be as low as 30,000. On this basis some 140,000 computers would be required; however, this ignores the number of computers acquired by schools

in the meantime. Costs will be dependent on the market response to the procurement approach taken and the extent to which school classrooms are currently equipped. As recognised earlier, a phased roll-out may be necessary due to constrained funding.

The Advisory Group expects that the necessary investment to realise the proposed infrastructure package, including the VLE, would require some €150m and should then be followed with an annual budget in the region of €30m for support, rolling replacement and enhancement of the service. While some phasing is likely to be necessary in the current climate, the Advisory Group believes it will be important to assure schools of the commitment to realising the package, over the period involved. This will enable schools to plan for their own individual ICT infrastructure needs.

Finally, the Advisory Group welcomes the decision by the Minister for Communications, Energy and Natural Resources to provide funding in 2009 for ICT teaching and learning equipment for the 78 post-primary schools which have been selected for the 100Mbps connectivity demonstration project.

6. Financial models

The recent National Competitiveness Council's *Statement on Education and Training*, published in March 2009, reinforced the importance of investing now in ICT for education, in spite of the current financial difficulties:

ICT development in schools is vital for the future competitiveness of the Irish economy. A number of innovative avenues of delivery remain to be explored, including the feasibility of acquiring low-cost competitively-procured (or leased) netbooks to second level students, degrees of cost sharing with parents, and exploiting the significant economies of free/open-source operating systems and applications.

The Advisory Group considered these and other issues relating to the funding of the required investment.

Overall procurement approach

Current procurement model

Currently, schools make their own ICT investment decisions using funds granted by the Department of Education and Science and the schools' own resources, with guidance from the NCTE.

Procurement frameworks have been put in place to simplify the buying of ICT hardware for schools and to acquire quality products and services at good value for money. Currently, there are four ICT procurement frameworks applicable to schools. Schools can buy ICT hardware from qualified suppliers by running "mini-competitions" within the Frameworks, often for very small quantities.

These procurement frameworks for schools stem from published guidelines from the Government's National Public Procurement Policy Unit in its document *National Public Procurement Policy Framework*¹⁵. Their guidelines suggest that ICT hardware falls into the category of "High Relative Spend – Easy to Secure Supply"; the purchasing strategy recommended is to reduce unit costs by leveraging volume demand into the market and reducing associated transaction costs.

While such an approach can lower the unit costs, there is significant scope to achieve better value for money by optimising the way ICT is procured, aggregating demand where possible and budgeting on a multi-year basis.

Future procurement model

Meeting the ICT requirements of schools should not just be seen in terms of procuring hardware at the lowest unit cost, but rather in a more holistic way. This means recognising that the requirement is to provide a complete learning environment for teachers, students and parents, and to do so in a way that is secure, reliable, scalable and fit for purpose. Schools' ICT should be categorised in Quadrant 4 of the NPPU's Supply Positioning Matrix – "High Relative Spend – Difficult to Buy".

Therefore, the Advisory Group recommends that the procurement strategy to achieve value for money for ICT equipment in schools should be through effective supplier selection and strong relationship management. This is a different procurement philosophy and one that would allow the ICT industry to engage more proactively than at present and to deliver long-term value.

¹⁵ The *National Public Procurement Policy Framework* is a set of guidelines for driving the four strands of the procurement reform agenda, ie, aggregating public sector demand, building procurement capacity/capability in the public sector, developing procurement training and education and incremental development of e-Procurement systems.

Aggregation of demand

To successfully implement a national solution and to achieve best value for money, the Advisory Group recommends that ICT requirements be aggregated to a much greater degree than at present. This does not necessarily mean that a single technology choice has to be imposed. Schools can retain a level of choice and control, while participating in a nationally procured solution which benefits from significant economies of scale and an affordable support model that underpins it.

Multi-annual budgeting

Once-off capital grants will not enable a comprehensive national solution to be put in place and sustained. **Given the scale of the implementation task and the need for ongoing support and development, the Advisory Group recommends that multi-annual budgeting is a necessary change in management approach.** This in turn will allow schools to conduct e-learning planning on a multi-annual basis.

Financing

With a multi-annual approach to budgeting, consideration should be given to financing models that spread the cost in a predictable way.

In a finance lease, for example, the lessee (or purchaser) has use of the asset over most of its economic life and beyond, generally by making small “peppercorn payment” (a very small payment used to satisfy the requirements for the creation of a legal contract payment at the end of the lease term). A finance lease includes a straightforward interest payment on an annual basis.

The other way in which financing can be arranged is an operating lease where the lessee only uses the asset for some of the asset’s life. It is designed to remove the requirement for an up-front capital outlay and refresh the infrastructure in a predictable interval that reflects the useful life of the equipment.

Such models could allow the Government to have better control over the expenditure for the required infrastructure. This is accepted best practice in the private sector as companies look to manage their investments in the most efficient and cost-effective manner.

Therefore, the Advisory Group recommends that the Department of Education and Science and the Department of Finance examine a leased financing model on the basis that it could bring benefits and savings to the public funding of ICT in schools.

Cost-sharing with parents

There are examples from Portugal and the Netherlands where parental contributions have been used in innovative ways to purchase ICT equipment. Indeed, many Irish schools have fundraised for the provision of ICT equipment also. In certain circumstances, tax relief is available on donations to schools, as approved charities and in respect of certain tuition fees. The Advisory Group recommends that the potential to expand the tax relief arrangements to encourage parental investment in schools ICT equipment be assessed and that models of cost-sharing be explored in the context of international experience.

VAT reduction on equipment and content used for ICT in education

The Advisory Group recommends that the possibility of reducing or eliminating the VAT element for the purchase of ICT equipment or software for use in schools be considered. This recommendation has also been made by the Institute of International and European Affairs (IIEA) in its recently published report *The Next Leap*¹⁶. The Advisory Group contends that ICT equipment should be considered as essential to education as school books and should be either VAT exempt or zero rated.

Outsourcing

The Advisory Group recommends that the Department of Education and Science begin the implementation of a plan to address the technical support requirements of schools. The provision of a centralised technical support service will allow for the aggregation of individual school needs across the country and ensure better value for money, rather

¹⁶ *The Next Leap: Competitive Ireland in the Digital Era*, published by the IIEA, December 2008.

than each school sourcing its own support systems. **The Advisory Group recommends that a centralised technical support solution be trialled as part of the 100Mbps project at second level and that the experience of the VECs be investigated. The Group recommends that proposals for a national solution should be prepared by 2012.**

Choice of classroom devices

The availability of increased bandwidth to schools in the near future, along with devices such as netbooks, raises new options for the delivery of ICT in schools. It is possible to envisage the use of less expensive classroom devices with remote administration and content management, eg, using cloud computing and thin/virtualised client concepts.

At the moment, the benefits of such solutions in operational and economic terms are unproven in an Irish educational context. However, the 100Mbps demonstration project offers an opportunity to evaluate proof-of-concept implementations.

The Advisory Group recommends that the NCTE evaluate the technical, operational and economic feasibility of thin/virtualised client implementations, and to do so in parallel with the deployment of teacher laptops and projectors, so as not to unduly delay the overall programme of investment.

The software environment

The Advisory Group recognises that there are “mixed software environments” in use in some schools today, where commercial and open source software (OSS) are used in the same environment. OSS can be an important part of the ICT environment, and is complementary to, and is often included in, commercial software.

OSS can be characterised as software for which the source code can be read, modified and acquired free of charge or for a nominal fee. It is important to note that even though a free product may seem at face value an attractive proposition, software licence costs are only one aspect of the total cost of ownership of any ICT solution. For a valid comparison

to be made, extrinsic factors, including hardware, software, training, support, transition costs and exit costs etc, and intrinsic factors (accessibility/usability/language support/collaboration) must be fully considered and evaluated in the procurement decision.

The Advisory Group recommends a comprehensive approach to considering fitness for use and that total cost of ownership be adopted when considering all software options, such as open source, proprietary and mixed solutions.

Energy savings

The Advisory Group recommends that information is provided to schools on how to reduce energy costs with existing equipment, especially when replacing old equipment. In addition, further energy saving initiatives for schools should also be explored.

7. An ongoing role for the ICT industry

ICT Ireland and its members already make significant contributions to the education sector, primarily through corporate and social responsibility programmes, estimated at an annual value in the region of €10 million (based on a survey of a sample of ICT Ireland members). The details of the type of initiatives are included in Appendix 3.

Industry has a wide level of expert resources in the area of educational technology that can be used to supplement and support the professional development of teachers. Such expertise will help to fast track the training of teachers and hence the wider deployment of technology throughout all schools.

It has become clear through the work of this Advisory Group that there is value in closer communication between the Department of Education and Science, its agencies and industry. Within the industry, there is a willingness and desire to play an ongoing role in the planning and implementation of ICT in schools and to facilitate a national programme of expert support and engagement between industry, teachers and students.

The Advisory Group recognises that it will take considerable time to develop a world-class ICT in schools environment but believes that the process can be speeded up by a serious and significant level of engagement between industry and education. Industry can provide the resources and expertise necessary to support teacher professional development and creation of digital content through a well co-ordinated programme, as highlighted in chapter 6 of this report.

Therefore, the Advisory Group proposes that a co-ordinated programme be established by ICT Ireland and the NCTE/Department of Education and Science, to advise, guide and support ICT infrastructure development in Irish schools and specifically to develop, where relevant and feasible, the following:

- A work placement programme for unemployed ICT and teaching graduates to work in industry to develop digital educational content;

- A recognition programme for teachers who reach certain standards in ICT related courses;
- Industry recognition for schools which reach certain targets for integration of ICT (awards, accreditation and certification). This could build on the existing Digital Schools Award scheme;
- The promotion of a central resource for industry-designed teacher professional development (see Appendix 3 for some current examples) to all teachers;
- The availability of industry in-company training for teachers;
- An ICT Ireland and NCTE co-ordinated mentoring programme for the ICT industry to act as mentors to ICT coordinators and teachers;
- The sharing of best-practice in the use of teaching and learning digital content and equipment.

Apart from the above specific actions, industry will fully participate in the proposed ICT in Schools Steering Group to oversee implementation of the ICT in Schools Strategy.

Appendix 1: Terms of Reference for ICT in Schools Joint Advisory Group to Minister for Education and Science

The Group will comprise members of ICT Ireland, the Telecommunications and Internet Federation (TIF), the Irish Software Association (ISA), the Department of Education and Science and the National Centre for Technology in Education.

Its purpose is to explore the possible approaches to implementing the recommendations set out in the report of the Strategy Group *Investing Effectively in ICT in Schools*, having regard to the funding available for ICT in the Department of Education and Science budget. In this context, the Group will:

- Assist in planning for future ICT infrastructural development in schools;
- Provide advice on the ongoing and future potential of ICT in schools to enhance teaching and learning;
- Provide a focus, whereby the contribution by industry in Ireland to the integration of ICT in schools can be discussed and identified;
- Explore the potential to develop links and partnerships to enhance collaboration between schools and the ICT industry.

Appendix 2: Teacher development material available from industry

MICROSOFT

- **Microsoft Digital Literacy:** (teach and assess basic computer concepts and skills, so that people can use computer technology in everyday life); and Microsoft Agreement.
- **Microsoft Partners in learning:**
 - ✓ ICT Skills for Teachers (introduce new users to ICT skills in the context of their roles as teachers);
 - ✓ One Step Further (develop the information skills and take teachers one step further in their developing ICT literacy);
 - ✓ ICT Integration (WebQuests);
 - ✓ ICT Leadership for Education Managers;
 - ✓ 21st Century School Leadership;
 - ✓ Peer Coaching;
 - ✓ Deploying Student Technical Support Solutions.

IBM

- **KidSmart:** training materials for teachers (and parents) available on-line, addressing the use of ICT in early education.
- **Learning Village:** a wealth of tools available on-line through the Learning Village platform for primary school teachers to collaborate and create sharable teaching plans and materials (all subjects) linked to the Irish curriculum. Now owned by

Houghton Mifflin Harcourt Learning Technology, this platform can also enable coaching of new and returning teachers by more experienced colleagues or from teacher training colleges anywhere in Ireland.

- **TryScience:** training materials and stimulating science activities available on-line for teachers and parents to use with 8-14 year old students.
- **Change Toolkit:** online training materials and sophisticated action tools to support school managers in leading change in their institution.

BT

- **The BT Better World Campaign** is focused on improving speaking and listening skills, so that people understand each other, have effective conversations, and collaborate with each other to achieve their goals. The campaign aims to develop these skills by providing:
- **Free resources** (from DVDs and online activities to books, downloadable guides, radio podcasts and free website service) for teachers, pupils and families. These are developed with teachers and tested in the classroom. They link to core curriculum requirements and have been endorsed by governments, teaching authorities and the teachers who use them;
- **School visits** and events delivered by BT Volunteers or specialist drama teams. Nearly 3,000 trained volunteers – BT employees, pensioners, their friends and families – visit schools giving lessons, running workshops and encouraging activities, which help to develop young people’s speaking and listening skills;
- **Training through dialogic** (ie, using dialogue) training techniques. BT has produced a free printable resource for teachers called How to focus on speaking and listening across the curriculum. The resource includes ideas on modelling, working in groups and managing whole-class activities.

APPLE

- **Apple Regional Training Centre Programme:** The Regional Training Centre programme helps teachers bring learning to life with digital technology. A nationwide network of Apple-approved Regional Training Centres (RTC) coach

primary and secondary teachers in the use of Apple's award-winning software packages – giving them the know-how to enliven school lessons with images, video and sound. <http://www.apple.com/ie/education/rtc/>

One regional training centre runs a very successful pan-European project. Eurocreator I Training Centre runs a very successful pan European project. Eurocreator <http://www.eurocreator.com> is a great moderated source and system for the sharing of digital media, videos, audio files etc, in school environments.

- **Apple Learning Interchange:** Educator created lessons and activities, rich with movies, images and podcasts, special collections from content providers. <http://ali.apple.com>
- **iTunes U:** iTunes U, part of the iTunes Store, provides a collection of free educational media available to students and teachers. With over 100,000 educational audio and video files available, iTunes U has quickly become an engine for mobile learning. <http://www.apple.com/education/mobile-learning/>

Two specific samples of learning and teaching development material on iTunes U are available at these links:

- ✓ Learn and Teach Scotland
<<itms://deimos3.apple.com/WebObjects/Core.woa/Browse/ltscotland.org.uk>>;
 - ✓ Teachers TV
<<itms://deimos3.apple.com/WebObjects/Core.woa/Browse/teachers.tv>>.
- **iLife and iWork Training:** Apple offers Associate Certification and preparatory training for the iLife and iWork product suites. Professionals, educators and students can earn Apple Certified Associate status to validate their skills in digital lifestyle and authoring applications.

Appendix 3: Contribution of ICT Industry to the education system in Ireland

ICT Ireland and its members contribute significantly to the education sector in Ireland. The following is a list of the types of initiatives and programmes that are being run by companies from ICT Ireland, the ISA and TIF. This is not a definitive list but it does demonstrate the breadth of the industry's commitment to the education community. Please note that the figures quoted are estimates.

Education initiatives currently being undertaken by companies:

Primary school initiatives	Secondary school initiatives	Third level initiatives
Company visits	Company visits	Company tours
Computer clubhouses	Computer clubhouses	Conferences
Education campaigns	Education campaigns	Course content
Education conferences and events	Education workshops	Graduate placement programme
Education workshops	IT equipment to secondary schools	Internship programme
IT equipment provision	Mentoring programmes	IT equipment provision
Mentoring programmes	School visits	Mentoring
School visits	Sponsorship of education	Research and development programmes
Sponsorship of education events	Tailored education programmes	Scholarships and awards
Tailored education programmes	Teacher training	Sponsorship
Teaching and learning material	Teaching and learning material	Teacher training at third level
Training of teachers	Training of teachers	

Appendix 4: Glossary

ICT	Information Communications Technology
STEM	Science, Technology, Engineering and Maths
OECD	Organisation for Economic Co-operation and Development
VLE	Virtual Learning Environment
NCTE	National Centre for Technology in Education
PISA	Programme for International Student Assessment
NCCA	National Council for Curriculum and Assessment
VLE	Virtual Learning Environment
TCO	Total Cost of Ownership
LAN	Local Area Network
NPPU	National Public Procurement Policy Framework Unit
IIEA	Institute of International and European Affairs
VEC	Vocational Education Committee
OSS	Open Source Software
ISA	Irish Software Association
TIF	Telecommunications and Internet Federation

ICT Ireland
Confederation House
84-86 Lower Baggot Street
Dublin 2
Tel: + 353 1 6051500

Department of Education and Science
Marlborough Street
Dublin 1
Tel: + 353 1 8896400