The 2013 ICT Census in Schools Summary Report

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PREFACE

The ICT Policy Unit of the Department of Education and Skills set up the Digital Strategy Development Group which is currently preparing a Digital Strategy for Schools. In spring 2013, as part of this process, the PDST-TIE (Professional Support Service for Teachers – Technology in Education, formerly the National Centre for Technology in Education), undertook a census of ICT in primary, post-primary and special schools on behalf of the Department. Principal teachers of all schools in each sector were asked to complete an online School Questionnaire, while samples of class teachers in each sector were asked to complete an online Teacher Questionnaire. The questionnaires were designed to gather data relating to the following themes:

- The impact of ICT on teaching, learning and assessment.
- School-wide planning for integration of ICT in teaching and learning.
- The current ICT infrastructural base across schools.
- Continuing ICT-related professional development for teachers.
- Access to:
    - ICT equipment.
    - Curriculum-relevant digital content and software resources, generally and in specific contexts (special education needs, literacy, numeracy).
- Views on the opportunities presented by the integration of ICT into teaching, learning and assessment.
- Obstacles to ICT integration and how they could be overcome.
- Views and experience on the relevance of ICT in specific contexts (e.g., literacy and numeracy, special educational needs).
- Exploring current practice and views regarding a range of areas, including (but not limited to):
    - Use of ICT in formative and summative assessment.
    - Technical support in schools.
    - Integration of student devices for learning.
    - E-books.
    - Virtual learning environments and other collaborative platforms within or across schools.
    - E-portfolios.
- Pupils' access to ICT for learning outside the school context.

The Department of Education and Skills awarded a contract to a consortium comprising the Educational Research Centre and the Education Department, St Patrick's College to conduct analyses relating to the 2013 ICT Census. The contract required the consortium to:

- Review draft census questionnaires.
- Prepare a comprehensive analysis of all the survey data collected and present it in a report containing:
    - An executive summary.
    - A detailed analysis of the findings in relation to key themes and other parameters, involving the analysis of responses to individual questions and the identification of significant correlations emerging from cross-analysis between responses.

- Conduct an international comparison using existing published data, comprising two elements:
    - A quantitative assessment of the position of Ireland in relation to a selection of no more than 10 quantitative indicators (covered by survey questions) in OECD countries.
    - A qualitative comparison, reviewing major international trends in relation to key themes.

While the consortium was asked to analyse the census data, the actual census was conducted by the PDST Technology in Education (formerly NCTE).

This summary report is divided into 10 chapters. Chapter 1 situates the 2013 Census in the context of current educational reform efforts as well as earlier audits of ICTs in schools. Chapter 2, a literature review, focuses on current international research and trends in three areas: infrastructure; learning, teaching and assessment through the use of ICT; and teacher professional learning. Chapter 3 describes administration of the 2013 Census.

Chapter 4 concerns ICT infrastructure in schools. Its focus is on the responses provided by school principals to a broad range of questions addressing themes such as availability of ICT devices, school websites, procurement frameworks, and provision of technical support. Chapter 5 describes the views of school principals on ICTs in teaching and learning based on their responses to the School Questionnaire. Chapter 6 summarises an analysis of comments offered by school principals on the School Questionnaire.

The focus of Chapters 7 and 8 shifts from school-level issues related to ICT to classroom-level issues. Chapter 7 addresses key findings drawn from the questionnaire completed by teachers. Chapter 8 summarises the comments provided by teachers on the Teacher Questionnaire.

Chapter 9 describes data on ICT usage drawn from recent international studies of educational achievement. Chapter 10, the final chapter, comprises a set of conclusions drawn from the literature review (summarised in Chapter 2) and the findings described in Chapters 4-9.

This Summary Report represents a selection of the findings from the Main Report on the 2013 ICT Census in Schools. Readers wishing to learn more about the outcomes of the 2013 Census are directed to the Main Report, and to the accompanying book of Appendix Tables. Both volumes can be downloaded at http://www.erc.ie/publications

ACRONYMS

CPD	Continuing Professional Development
DCENR	Department of Communications, Energy and Natural Resources
DES	Department for Education and Skills (previously, Department of Education and Science)
DEIS	Delivering Equality of Opportunity in Schools
ESRI	Economic and Social Research Institute
ICT	Information and Communications Technology
IEA	International Association for the Evaluation of Educational Achievement
NCTE	National Centre for Technology in Education
OECD	Organisation for Economic Cooperation and Development
PDST-TIE	Professional Development Service for Teachers – Technology in Education (formerly, NCTE)
PIRLS	Progress in International Literacy Study
PISA	Programme for International Student Assessment
TIMSS	Trends in International Mathematics and Science Study

1 - CONTEXT OF THE 2013 CENSUS

As noted in the Preface, the 2013 ICT Census of Schools took place in a context in which a Digital Strategy for Schools was being prepared by the Department of Education and Skills. The census also took place in a context in which the integration of ICTs into teaching and learning is constantly changing; substantive improvements in technology have occurred in recent years and expectations for ICT use of primary and post-primary schools have heightened. The impetus for change has come from inside the educational system (e.g., the development of new curricula at primary level, implementation of Project Maths, planned changes to the Junior Cycle, and changes to a number of subjects at Senior Cycle), from Irish society more broadly (e.g., the *National Digital Strategy for Ireland*, DCENR, 2013), and from Europe (e.g., the *Digital Agenda for Europe*, European Commission, 2010, 2013). Internationally, some progress has been made in understanding how teachers can be best supported to integrate ICT into teaching and learning (e.g., UNESCO, 2008a, 2011). Student competence in the use of ICTs is now considered essential in its own right, as is the development of other '21st century skills' such as creativity, innovation, collaboration and problem solving, through the use of ICTs.

A number of key national reports and strategies have been published since the last ICT Census in 2005. A report by the Inspectorate of the (then) Department of Education and Science, *ICT in School. Inspectorate Evaluation Studies* (DES, 2008), highlighted positive aspects of ICT usage in schools, but also pointed to deficiencies in infrastructure, technical support, and the integration of ICTs in teaching and learning. The report pointed to particular gaps in ICT skills among students in both primary and post-primary schools. A key finding was that access to computers by students was greater when computers were located in students' classrooms. Two policy-driven reports, *Investing Effectively in Information and Communications Technology in Schools* (Minister's Strategy Group, 2008) and *Smart Schools = Smart Economy* (ICT in Schools Joint Advisory Group to the Minister for Education and Science, 2009), outlined strategies for improving ICT usage in schools. Both strategy documents highlighted the key role of teacher professional learning, along with the need to provide appropriate, classroom-focused digital content, to develop broadband capacity, and to address maintenance and support issues.

Following extensive Government spending on ICTs as part of the *Schools IT 2000* (DES, 1997) and *Blueprint for the Future of ICT in Irish Schools* (DES, 2001) initiatives, direct funding to schools has continued, albeit at a slower pace. Following the publication of the *Smart Schools = Smart Economy* report in 2009, the Department provided schools with equipment grants at a cost of €92 million. More recently, post-primary schools have been provided with 100 Mbps broadband at an estimated cost of €51 million in a joint initiative involving the Department of Communications, Energy and Natural Resources and the Department of Education and Skills. Currently, the Department of Education and Skills supports schools in meeting ongoing costs of broadband.

Several international studies published in recent years have drawn attention to low average levels of ICT usage by students in schools in Ireland. For example, the PISA 2012 study pointed to low levels of computer use by Irish 15-year olds at home for schoolwork, and at school for school-related tasks (Perkins et al., 2013). An EU Survey of Schools (the ESSIE study), which was conducted in autumn 2011, drew attention to heavy usage of ICTs by teachers in Ireland to present lesson content, coupled with low levels of ICT usage by students (European Schoolnet and the University of Liege,

2012). Consistent with PISA, students in second and fifth years in Ireland in the ESSIE study ranked 26th of 27 countries in their use of ICT-based activities during lessons, including searching on the Internet, posting homework on the school website and using computers to conduct experiments.

The 2013 Census of ICT in Schools is one of several strands feeding into the development of the Digital Strategy for Schools. In December 2013 the DES launched a public consultation, in which various stakeholders, including teachers and parents, could contribute their views on the effective use of ICTs in schools. Focus groups with students, parents and teachers have also been conducted.

2 - WHAT THE LITERATURE SAYS

A detailed review of international research on the use of digital technologies in schools was presented in Chapter Two of the Main Report. As a starting point, the use of ICT to support the type of learning envisioned in the 21st century was recognised as challenging, and the concept of teaching, learning and assessment through the use of ICT was presented as only one part of a complex jigsaw. If change is to occur and ICT successfully used to support learning, there is a need to consider the implications for all aspects of the education system. This includes pedagogy, teacher practice, professional development, curriculum, assessment, and school organisation and administration, all of which work together and reinforce each other as part of an interrelated and interdependent learning ecosystem.

The UNESCO framework (2008a, 2008b, 2011) was used to frame the review. The framework includes six components (understanding ICT in education, curriculum and assessment, pedagogy, ICT, organisation and administration, and teacher professional learning), and three broad approaches (technology literacy, knowledge deepening and knowledge creation) (Figure 2.1). It provides both a way of organising the discussion and a lens to conceptualise what being digital in learning can look like. It is useful as a means to review what has been accomplished in Ireland to date and to provide indicators of what needs to be developed going forward.

Figure 2.1: The UNESCO Framework (2011)

Aspect/Approach	Technology Literacy	Knowledge Deepening	Knowledge Creation
Understanding ICT in Education	Policy awareness	Policy understanding	Policy innovation
Curriculum and Assessment	Basic knowledge	Knowledge application	Knowledge society skills
Pedagogy	Integrate technology	Complex problem solving	Self-management
ICT	Basic tools	Complex tools	Pervasive tools
Organisation and Administration	Standard classroom	Collaborative groups	Learning organisations
Teacher Professional Learning	Digital literacy	Manage and guide	Teacher as model learner

Source: UNESCO (2011), p. 3.

The review of literature focused on three broad areas: ICT infrastructure in schools; learning, teaching and assessment through the use of ICT; and teacher professional learning. These themes were perceived to encapsulate the key aspects of a learning system as identified by the UNESCO framework (2011) and also to correspond to those examined in the Census.

Infrastructure

The review of literature focused on three important components of ICT infrastructure: Internet connectivity, hardware, and technical support and maintenance.

Internet connectivity

Access to high-speed broadband is now a critical component of school infrastructure in that a school's broadband bandwidth increasingly determines the online content, functionality and applications that students and teachers will be able to use effectively in the classroom (Fox, Waters, Fletcher & Levin, 2012). As a consequence, it is no longer sufficient to provide Internet connectivity in schools; rather, the strength and bandwidth of the connection to schools must be taken into consideration to ensure consistently high-quality user experience. To this end, all network applications and traffic, as well as technologies for more efficient use of bandwidth, should be factored into the architecture and design of school networks (CISCO, 2013). Recent trends indicate that bandwidth requirements are set to further increase in schools over the next few years. A white paper produced by CISCO (2013) notes that, in the USA, there will be a requirement for Internet access of 2Mbps per student by 2018, while the State Educational Technology Directors' Association estimates that 10Mbps will be needed (Fox et al., 2012). Although these sets of targets may seem high, CISCO argues that such levels of connectivity are required because the density of devices and users per square foot in a school are among the highest found in any work environment.

Hardware

To take advantage of the content, functionality and applications provided by high speed broadband, schools need computers that are powerful enough to support high-quality user experiences, to which students must have access. The improvement of student-to-computer ratios in schools continues to be prioritised in countries across the world, even amongst those that report sufficient levels of hardware access. For example, Australia, Canada, Estonia, Israel, Japan, Korea and New Zealand are aiming to have a one-to-one computer ratio for at least subsets of students (Bakia, Murphy, Anderson & Trinidad, 2011). In keeping with technological developments, the trend has also been towards the use of progressively smaller, more portable computers. The 2013 Horizon report on emerging technologies in education predicted that tablet computing, along with other mobile devices and apps, was likely to enter into the mainstream for schools within one to two years (Johnson et al., 2013). A growing number of schools are also launching "Bring Your Own Device" (BYOD) programmes so that students can use the devices they already own in class.

Access to other technologies, such as cloud computing, is an emerging trend. Cloud computing, which comprises services that are made available to clients from a third-party service provider, via the Internet, presents a viable solution to the ongoing expense of procuring and maintaining a wide range of hardware and software in schools. As schools develop their infrastructures to support one-to-one learning and BYOD deployments, they are beginning to use cloud services to make it easy for students and teachers to access resources from any device (Johnson et al., 2013). However, it is also noted that as schools adopt cloud-computing services and transfer increasing quantities of student information to third-party providers, ethical issues in terms of data ownership, private security, digital footprints and conglomerate monopolies become more salient and contentious.

Technical support and maintenance

The provision of appropriate, reliable and cost effective technical support solutions is emphasised as an essential condition for sustainable integration of ICT in schools. The need for technical support to be available as needed by schools and teachers is undisputed; countries that provide the highest levels of technical support have been found to have the highest levels of ICT usage in classrooms (e.g., Hong Kong, Singapore) (Pelgrum, 2008). It is also apparent that as cloud and mobile technologies become ubiquitous in schools and networks become more complex, schools will face even greater challenges. They will increasingly need a greater array of service offerings, ranging from basic maintenance to professional services and support networks as they deal with issues relating to procuring, monitoring and supporting cloud services and mobile devices, as well as issues of interoperability. An essential aspect of infrastructure investment in schools must therefore be to exercise careful consideration and planning for ICT purchase, installation and training, as well as for the provision of user support, technical support, and maintenance (GESCI, 2009). However, schools cannot be expected to deal with such complex issues individually and without guidance. Based on the international literature, access to a coordinated, integrated, system-wide approach to technical support and maintenance at a national level is essential to ensure functioning and reliable technology in schools. In this context, several countries have begun to link infrastructure investments to explicit requirements around training and professional development, maintenance and technical support, and technology management at national and/or programme level.

To conclude, it is noted that although countries worldwide continue to prioritise infrastructural improvements, simply investing in the procurement of more technology for schools does not by itself lead to the transformation of education. In fact, there is evidence to suggest that an over-emphasis on hardware can shift the focus from potential learning opportunities, and prioritise the technology above teaching (Luckin et al., 2012). There is also a significant body of evidence to show that whether or not technology affects learning outcomes is determined by *how* it is used (Langworthy et al., 2010).

Learning, Teaching and Assessment through the Use of ICT

Given that the relationship between teaching, learning, and assessment through the use of ICTs is highly complex, one would not expect the introduction of ICT into a learning environment to bring about change in pedagogical practice in and of itself. Rather, we would expect the use of ICTs in education to be inextricably linked with teacher understandings of teaching and learning (Becker, 2000; Becker and Riel, 1999; Bransford, Brown & Cocking, 2000; Cuban, 1993, Jones & Mercer, 1993). Pedagogies associated with the innovative use of ICT include ones that emphasise high levels of understanding of key concepts within subject areas and the ability to apply these concepts to solve complex real-world problems. Most recently, curriculum development initiatives have emphasised "21st century skills" (often referred to as "Key Skills" or "Key Competencies", ETA, 2010; NCCA, 2008, 2009; OECD, 2005), qualities that prepare students to live and work in a digital society. These include skills such as critical thinking and problem solving, communication, collaboration, self-regulation and information management (Binkley et al., 2012, Partnership for the 21st Century, 2008). The ability to use technology effectively and reflectively is identified as a key competence in these initiatives, each of which stresses the potential of digital technologies to transform the

learning experiences of students, by helping them become engaged thinkers, global citizens, and active learners in collaborative social learning environments.

The research evidence indicates that teachers' understandings of 21st century skill requirements influence the ways in which they use ICT (Butler & Leahy, 2010a, 2010b, 2011; Leahy & Butler, 2011; Plomp et al. 2009; Shear, Butler & Leahy, 2011; Shear, Gallagher & Patell, 2011; Shear, Gorges et al., 2010; Shear, Novias & Moorthy, 2010)). When teachers' pedagogical orientations are driven by understandings of 21st century learning, they are known to take on a more facilitative role, provide student-centred guidance and feedback, and engage more frequently in exploratory and team-building activities with students. According to the UNESCO (2008a, 2008b, 2011) competence framework (ICT-CF), this is a knowledge deepening approach and implies that teachers make use of ICTs in ways that support an enquiry process, enabling their students to work on solving complex real-world problems. This approach emphasises depth of understanding while also providing opportunities to engage in collaborative project-based learning activities that go beyond the classroom. A knowledge creation approach builds further on this, suggesting that the curriculum goes beyond a focus on knowledge of school subjects to explicitly include the knowledge, skills and competences that are needed to create new knowledge, including problem solving, communication, collaboration, experimentation, critical thinking, and creative expression. The teacher's role in a knowledge creation approach is to design a learning community which makes pervasive use of technology to support students who are creating knowledge products and are engaged in planning and managing their own learning goals and activities. In this learning environment, a variety of networked devices, digital resources, and electronic environments are used to create and support the community in its production of knowledge and collaborative learning.

Current trends in ICT use highlight that, both internationally (European Schoolnet & University of Liege, 2012; Shear, Butler & Leahy, 2011) and nationally (e.g., Conway & Brennan, 2009), the most common teacher and student uses of technology are at the technology literacy level (UNESCO, 2008a, 2008b, 2011). For teachers, by far the most common use of technology is in preparation for teaching and in giving instruction and presenting information during lessons. Few teachers use ICT to work with students during lessons and, when they do, student use of ICT is basic. The majority of students use ICT to find information on the Internet, practice routine skills, or take tests. The uses of ICT in ways that can be described as 'knowledge deepening' or 'knowledge creation' are much less common. Although some students do have access to innovative teaching and use ICT to support their learning, such practices often take place in isolation (Shear, Gorges et al., 2010, Shear et al., 2011). When they occur, the underlying pedagogical approach supports the innovative practices and not simply the introduction of new technologies.

Movement towards the 'knowledge deepening' and 'knowledge creation' approaches will represent quite a radical shift in pedagogical orientation for many teachers and require significant investment of effort, individually and collectively (OECD, 2010). If systemic change is to occur, the use of ICT needs to be linked to national policy initiatives or priorities. A motivation to drive the need for such change is required. Thus, if the school culture or national policy does not advocate or support these pedagogical approaches, it is not possible to have school systems that are functioning at the 'knowledge deepening' and 'knowledge creation' levels.

Assessment through the use of ICT

Shifts in pedagogical orientations, in particular those towards knowledge deepening and knowledge creation approaches to learning, emphasise a need for alternative approaches to assessment. At this point, ICT-supported student assessment is considered an emerging area as advances in digital technologies open up new alternatives to the old modes of assessment (Bakia et al., 2011; EACEA/Eurydice, 2009; Eurydice, 2011). As currently used, ICT mainly supports summative assessment although interest in formative and diagnostic assessment is growing, as is interest in how components of 21st century skills such as complex problem solving, communication, team work, creativity and innovation, can be assessed using technology (Binkley et al., 2012). In their landmark paper, Binkley et al. (2012) pointed out that there is little value in simply transferring paper-and-pencil multiple-choice tests to computer-based platforms, arguing that computer tools such as modelling, video data, data processing, simulation and visualisation should be utilised. In support of this, they point to a range of projects that have been successful in measuring at least some 21st century skills (e.g., 'World Class Tests', the Virtual Assessment Performance Project[1], the assessment of digital reading in PISA 2009 and 2012).

Teacher Professional Learning

Teachers in today's classrooms must not only be prepared to use technology but must also know how to use it to support student learning. According to UNESCO (2008a), these have become "integral skills in every teacher's professional repertoire" (p.1). However, if, as the research suggests, the use of these new technologies implies new teacher roles, together with new pedagogies and new approaches to teacher education (Makrakis, 2005), a reappraisal of the design of teacher professional learning as currently conceptualised in Ireland is needed. It is also important to reiterate that merely introducing new technology does not lead to change in and of itself and that it is often best to link the introduction of new technologies to other changes (Kozma, Vota & Bsaiso., 2010). Cognisance must also be taken of teachers' pedagogical orientations, as these are critically important in influencing the shape and form of how digital technologies are used in classrooms. For all of these reasons, careful consideration is needed as to how teacher professional learning can be designed to support teachers as they use technology to prepare their students to live and work in the 21st century. The UNESCO ICT Competency Standards for Teachers (ICT-CST) provides a useful lens through which to examine the ways in which teacher professional learning can be conceptualised and designed (UNESCO, 2011).

Technology literacy

The most basic level of teacher understanding of technology has been called technology literacy. A focus on technology literacy in professional learning for the most part maintains the status quo with regards to overall structures within the educational system in that there is no significant change to pedagogical practices. Teacher competences related to technological literacy include basic digital literacy skills, together with the ability to use off-the-shelf educational activities that are linked to standard curriculum objectives, assessment objectives, and didactic teaching methods (UNESCO, 2008b). Even when the focus is on supporting teachers' integration of ICTs into instruction, the role of the teacher is still largely traditional – presenting and explaining information and concepts, setting

[1] http://www.carla.umn.edu/assessment/vac/

learning tasks, and monitoring students' progress (Plomp et al, 2009). Professional development programmes in the area of technical skills have been more readily available than pedagogically-oriented ones, and there are concerns that they are simply 'retooling' teachers for specific tasks, rather than engaging them in pedagogy of a substantial nature (Watson, 2001).

Knowledge deepening

If ICT integration is to increase the ability of learners to apply school knowledge to solve complex real-world problems, teachers need to adopt a knowledge-deepening approach (Plomp et al., 2009). This approach emphasises depth of understanding over coverage of content, and the application of understanding to real world problems. The teacher's role is to structure tasks, guide student understanding, and support students as they tackle collaborative projects. In doing so, teachers employ open-ended ICT tools that are specific to their subject area (e.g. visualisations in science, data analysis tools in mathematics, and role play simulations in social studies) (UNESCO, 2011). Furthermore, as teachers support student-led collaborative projects, they should be able to use networked and web-based resources, which should help students collaborate, access information, and communicate with external experts to analyse and solve their selected problems. Teachers also need to be able to use ICT to create and monitor individual and group student project plans. As part of their own professional learning, teachers must be able to access information and expertise, and must collaborate with other teachers to support this learning (UNESCO, 2011).

In Ireland, proposed changes in curriculum and assessment at both primary and post-primary levels provide an opportunity to promote understandings of how to make innovative use of ICTs beyond "integration" (e.g. Junior Cycle, Project Maths, Integrated Primary Language Curriculum for infants to second class, review of primary mathematics, and revision of the Senior Cycle sciences). These changes provide opportunities to not only explore the possible uses of complex technologies in meaningful contexts but also to incorporate assessment into the ongoing activities of the class that focus on complex problem solving and emphasise the application of understanding to real-world problems (Binkley et al., 2012; Griffin et al., 2012; UNESCO, 2011).

Knowledge creation

If the goal is to nurture students to become citizens who continually engage in and benefit from knowledge creation, innovation, and participation in a learning society, teachers will need to adopt a knowledge-creation approach (Plomp et al. 2009). With this approach, the curriculum goes beyond a focus on knowledge of school subjects to explicitly include those skills that are needed to construct new knowledge (e.g. problem solving, communication, collaboration, experimentation, critical thinking and creative expression) (UNESCO, 2011). These lifelong skills become curricular goals in themselves and the objects of new assessment methods. Roles within the learning environment are thus significantly transformed. Students are expected to be able to create their own learning goals and plans in order to "establish what they already know, assess their strengths and weaknesses, design a learning plan, stay on-task, track their own progress, build on successes and adjust to failures " (UNESCO, 2011, p. 13). Teachers are expected to build a learning community in which students are continuously engaged in developing their own and each other's learning skills. Schools are thus transformed into continuously improving learning organisations in which all members are involved in learning. The use of ICT is pervasive in this networked *anytime, anywhere*, collaborative learning environment. In this context, teachers both model the learning process for students and

serve as model learners through their own ongoing professional development, individually and collaboratively (UNESCO, 2008b, 2011).

Strong support needs to be put in place by governments to support the development of such learning communities. Governments in countries such as Canada and Belgium are encouraging teacher participation in nationally-sponsored communities of practice (Bakia et. al., 2011). In Ireland, policy aspirations in this direction are evident in recently-published education policies and plans. The *National Strategy to Improve Literacy and Numeracy among Children and Young People* (2011-2020), (DES, 2011), *Project Maths*, *Key Skills Framework* (NCCA, 2009), the *Framework for the Junior Cycle* (DES, 2012a) and the *School Self-Evaluation Programme* (DES, 2012c, DES 2012d) all identify ICT as essential to teaching, learning and assessment and require that ICT be used as a part of student learning. While this recognition is important and a necessary starting point, what is urgently needed is a framework for teacher professional learning to mobilise how ICT can be effectively used in teaching, learning and assessment across each of these policy initiatives. In fact, if there is to be any significant or transformational change, it must be acknowledged that "teacher professional development has an impact only if it is focused on specific changes in teacher classroom behaviours and particularly if the professional development is on-going and aligned with other changes in the educational system" (UNESCO, 2008a, p.9).

Conclusion

The linking of investments in ICT to improvements in student outcomes is a challenge faced by all countries investing in the use of ICT in education. The present review pointed to the complexity of developing a Digital Strategy for Schools. Such a strategy must consider infrastructural issues but also how digital technologies are to be used in curriculum and assessment. Teachers' pedagogical orientations are pivotal in how the digital technologies are used. Although digital technologies can make things possible, it is people that make change possible. A critical component of the Digital Strategy for Schools must therefore be how teacher professional learning is conceptualised, designed and sustained. The Digital Strategy for Schools will have far-reaching implications for developing learning ecosystems which are centred on Knowledge Deepening and Knowledge Creation, rather than on Technology Literacy (UNESCO, 2008a, 2008b, 2011).

3 - IMPLEMENTATION OF THE 2013 ICT CENSUS

Two questionnaires were administered in the 2013 ICT Census of Schools: a School Questionnaire, which was completed by school principals in participating schools, and a Teacher Questionnaire, which was completed by selected teachers in those schools. Parallel School and Teacher Questionnaires were developed for primary, post-primary and special schools. The content of the questionnaires was guided by policy priorities of the Department of Education and Skills, and the ICT in Schools Steering Group[2] was also consulted. Key themes addressed in the School Questionnaire were ICT planning, ICT priorities, ICT infrastructure, use of ICT in general, and use of assistive technology. Questions were also asked about procurement frameworks, technical support and engagement with industry. Issues covered in the Teacher Questionnaire included general beliefs relating to teaching and learning, frequency of teaching and learning activities, access to ICT, use of ICT in teaching and learning, use of ICT in assessment, impact of ICT use, ICT planning and collaboration, ICT priorities, perceived level of ICT-related skills, time spent on ICT-related Continuing Professional Development (CPD), and ICT-related CPD content. Respondents to both School (principal) and Teacher Questionnaires also had the opportunity to offer comments at the end of the questionnaires. The 2013 Census was the first in which a Teacher Questionnaire was administered, and was also the first to be administered electronically.

The 2013 Census was implemented by PDST Technology in Education (formerly the NCTE) in spring 2013. All schools (primary, post-primary and special) in the country were contacted in mid-April by the DES. Principals were invited to complete the online School Questionnaire and were also asked to select teachers in their school to complete the Teacher Questionnaire. At primary level, principals were asked to select one second class teacher and one fourth class teacher; at post-primary level, they were asked to select two second year and two fifth year teachers; and in special schools, they were asked to select either one or two teachers. Guidelines for selecting teachers at random using a website that generated random numbers were included with the letters. In total, 2109 of 3120 School Questionnaires were returned from primary schools by the end of June, 2013, yielding a response rate of 67.6%. A total of 498 out of 721 School Questionnaires (69.1%) were returned by post-primary schools, while 90 of 140 special schools (64.3%) returned a School Questionnaire. As response rates for the Teacher Questionnaire were low at the end of June 2013, a second opportunity to complete questionnaires was provided in October 2013. Overall, at primary level, 2838 Teacher Questionnaires were returned from 6047 teachers in 1986 schools, giving a response rate of 46.9 percent. A total of 1110 post-primary Teacher Questionnaires out of 2782 expected were returned from 417 of 721 schools, yielding a response rate of 39.9 percent. Teacher Questionnaires were returned by 68 of 140 teachers in special schools (48.6%).

Sampling weights were constructed for the School Questionnaires for primary, post-primary and special schools. These were based on the assumption that non-responding schools were similar to responding schools in terms of ICT-related characteristics. Because of low responses rates for the

[2] The ICT in Schools Steering Group was established following the publication of the Smart Schools = Smart Economy report to provide a stakeholder forum and to advise on matters relating to the recommendations made in both the 2008 Department Strategy and the Smart Schools reports.

Teacher Questionnaires, and a lower likelihood of teachers in smaller schools responding, weights were not constructed for the Teacher Questionnaires. Hence, outcomes from the Teacher Questionnaires can only be interpreted as indicative and should not be generalised to the population of teachers. Both quantitative and qualitative analyses were conducted on the data.

4 - ICT INFRASTRUCTURE IN SCHOOLS

This chapter summarises the responses of principal teachers to items on the School Questionnaire dealing with infrastructure.

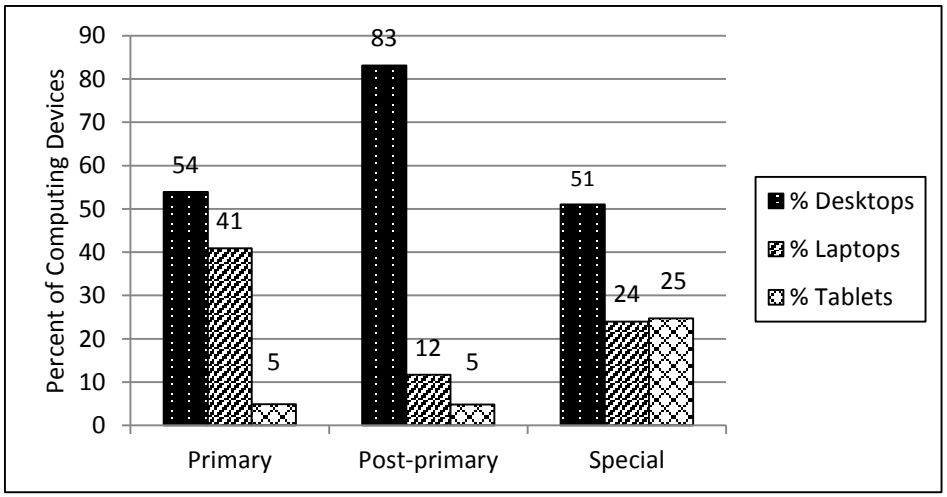
ICT Devices

In 2013, the overall average ratio of students to working computing devices in schools (i.e., devices for use for administration, teaching and/or learning) was 4.6 to 1 at primary level, 3.7 to 1 at post-primary level, and 1.7 to 1 in special schools. At primary level, Band 1 DEIS[3] urban schools (4.0:1) and DEIS Rural schools (3.1:1) had more favourable ratios than non-DEIS schools (4.8:1). At post-primary level, DEIS schools (2.9:1) also had a more favourable ratio than non-DEIS schools (4.0:1).

The ratios of students to computers/devices specifically for student use were 11.1 at primary level, 8.8 at post-primary level, and 3.3 in special schools. These less-favourable ratios reflect relatively large numbers of computing devices in schools that are designated for teacher use, or for use in school administration, and a lower number for student use.

In 2013, desktop computers accounted for 54% of working computers available to students in primary schools, 83% in post-primary schools, and 51% in special schools (Figure 4.1). Tablets accounted for 5% of devices in primary and post-primary schools, and one quarter of devices in special schools. The data indicate a shift in schools' purchasing practices, with schools at all levels tending to purchase more tablets and laptops in the two years prior to the census than in earlier years. The move towards mobile devices is particularly apparent in special schools.

Figure 4.1: Percentages of working computing devices available to students by type in primary, post-primary and special schools, by type of device

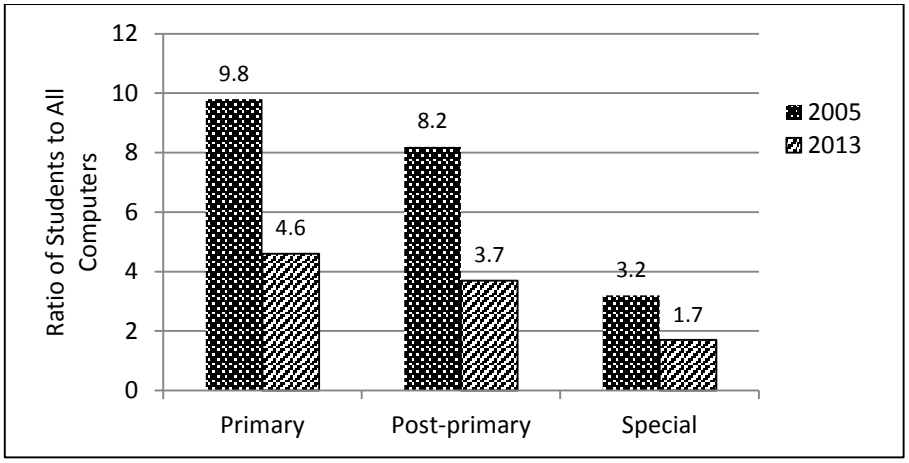


Missing data: Primary: 17-33%. Post-primary: 8-26%. Special: 13-27%.

[3] DEIS (Delivering Equality of Opportunity in Schools) is an action plan put in place by the Department of Education and Skills in 2005 to address the effects of educational disadvantage in schools. The School Support Programme (SSP), which comprises a set of measures and provides schools with additional human and material resources, is a key element of DEIS. At primary level, urban schools in the SSP are allocated to Band 1 or Band 2, depending on their average level of disadvantage. There is a separate set of measures for rural schools in the SSP.

The ratios of students to working computers (all computing devices in the school) were more favourable in all sectors in the 2013 Census than in the 2005 Census. At primary level, there has been an improvement from 9.8 to 4.6; at post-primary, from 8.2 to 3.7; and in special schools, from 3.2 to 1.7 (Figure 4.2). What these ratios do not tell us is how computers are being used, a theme that is explored in Chapter 7.

Figure 4.2: Ratios of students to working computers in primary, post-primary and special schools, 2005 and 2013



In 2013, almost all post-primary schools (99%) reported that they had a dedicated computer room. The corresponding estimates for primary schools and special schools are 33% and 28% respectively.

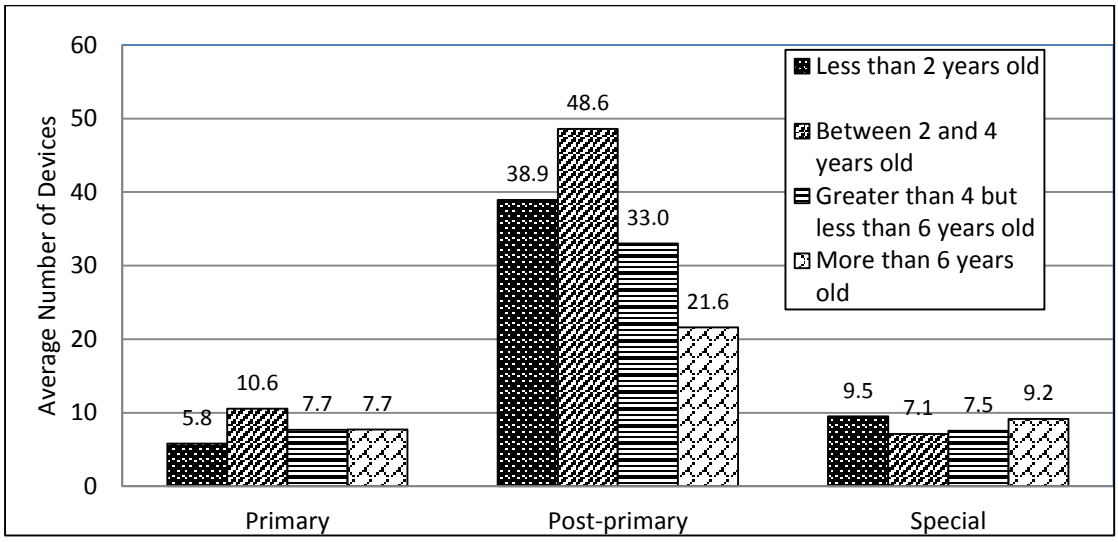
On average across primary schools, there were 7.3 devices for teachers located in general classrooms and 9.1 for students. At post-primary level, the corresponding averages were 23.8 (teachers) and 15.7 (students). Hence, on average, there were more computing devices for students than for teachers in general classrooms at primary level, and more computers for teachers than for students in such classrooms at post-primary level. The imbalance at post-primary is offset, at least in part, by the greater availability of computers for students in computer rooms.

Age of Computing Devices

On average, at primary level, 18% of all computing devices were under 2 years old in 2013; 33% were between 2 and 4 years old; 25% were between 4 and 6 years old; and 25% were more than 6 years old (Figure 4.3). At post-primary level, 27% of all computing devices were under 2 years old, 35% were between 2 and 4 years, 23% were between 4 and 6 years, and 15% were more than 6 years old.

Primary schools had an average of 6.6 interactive whiteboards, and an average of 6.4 digital projectors. Post-primary schools had an average of 29.5 digital projectors and 7 interactive whiteboards. Both digital projectors (4.8 on average per school) and interactive whiteboards (4.4 on average per school) were also found in special schools. Six percent of primary schools and one quarter of post-primary schools reported that they had no interactive whiteboards.

Figure 4.3: Average numbers of computing devices by age in primary, post-primary and special schools



On average across primary schools, 77% of computing devices in general classrooms and 90% in computer rooms (where such rooms existed) were connected to a fixed network, while 56% in general classrooms and 51% in computer rooms were linked to a wireless network. In post-primary schools, 87% of computing devices in general classrooms, and 97% in computer rooms were connected to a fixed network, while 61% in general classrooms and 62% in computer rooms were linked to a wireless network.

School Websites

Ninety-seven percent of post-primary schools, 71% of primary schools, and 65% of special schools reported that they had a website or blog. Among schools with a website/blog, 81% at primary level, 90% at post-primary level, and 57% in the special sector reported that they updated them regularly.

Procurement

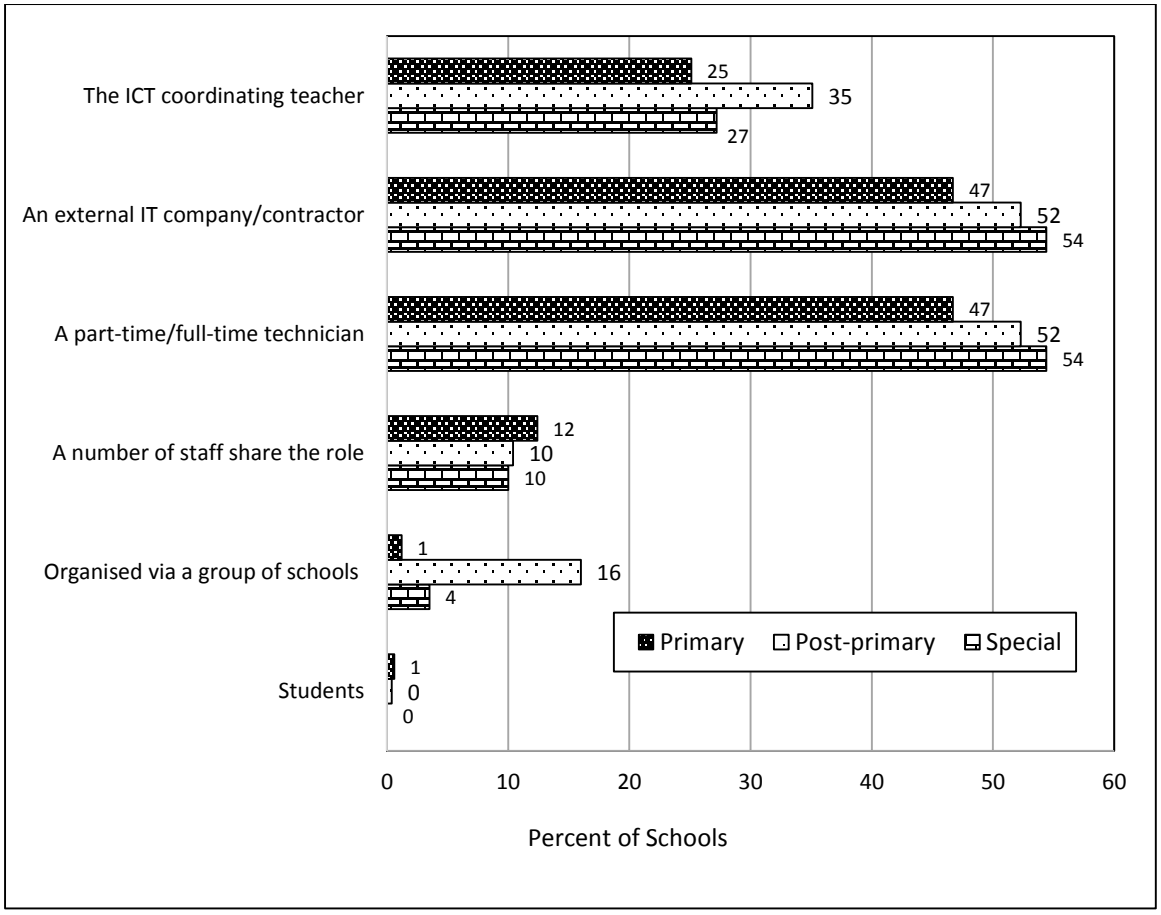
At primary level, one-fifth of principals were unaware of the framework for purchasing PCs on the PDST Technology in Education website. The corresponding figures for post-primary and special schools were 14% and 27% respectively. One-third of all principals in primary schools, 56% in post-primary schools, and 31% in special schools had used the PC framework and found it useful. Similar percentages had used and were satisfied with the frameworks for digital projectors and notebooks (laptops). One-third of primary principals, one fifth of post-primary principals, and over one quarter of special school principals were aware of the PC framework, but had not used it.

Responsibility for Technical Support

Principal teachers reported that responsibility for technical support in schools was shared by a number of persons. In one-quarter of primary schools, 35% of post-primary schools, and 27% of special schools, the ICT coordinating teacher was fully responsible or responsible to a large extent for support (Figure 4.4). In 47% of primary schools, 52% of post-primary schools, and 55% of special schools, an external IT company or contractor had these levels of responsibility. Almost 45% of

vocational schools were part of a group scheme that was fully responsible, or responsible to a large extent, for the provision of support.

Figure 4.4: Percentages of principals reporting provision of different types of technical support in their school, by school category (fully or to a large extent)



Conclusion

The overall ratios of students to working computing devices in 2013 were 4.6 to 1 at primary level, 3.7 to 1 at post-primary level, and 1.7 to 1 in special schools. These represent an improvement over the corresponding ratios in the 2005 Census. In 2013, ratios of students to computing devices for student use were less favourable than overall ratios – 11.1 at primary, 8.8 at post-primary, and 3.3 in special schools – reflecting a relative shortage of computing devices in schools for use by students. These data need to be interpreted in the context of policy initiatives designed to achieve 1:1 ratios in countries such as Australia, Canada, Estonia and New Zealand (see Chapter 2). While the relative numbers of portable computing devices for student use in schools are low, especially in post-primary schools, the tendency over the past two years has been for schools to purchase more portable devices.

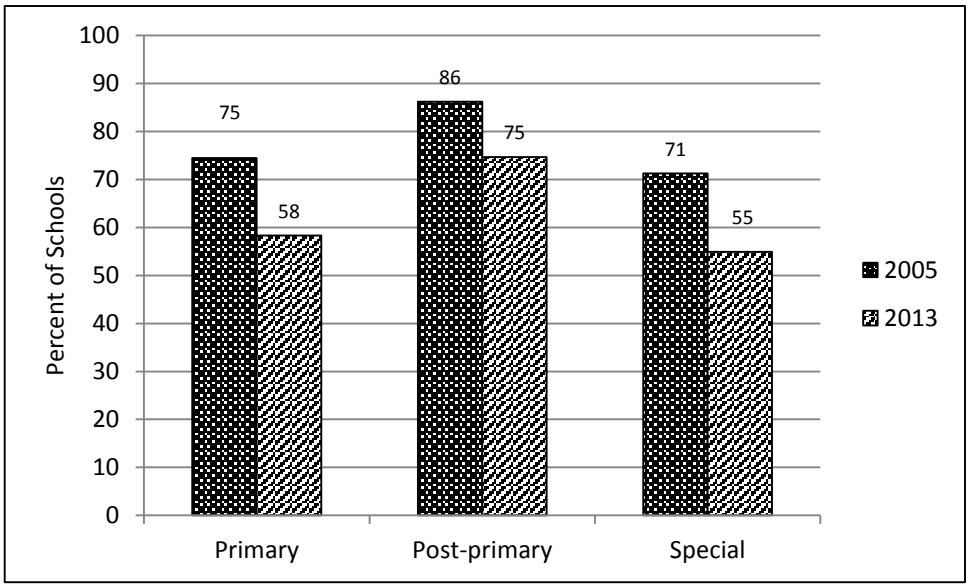
5 - ICTS IN TEACHING AND LEARNING: DATA FROM SCHOOL PRINCIPALS

This chapter summarises the responses of principal teachers to items on the School Questionnaire relating to the use of ICTs in teaching and learning, and teachers' continuing professional development as it relates to ICT.

Planning for ICT

In addition to providing information on infrastructure, principal teachers responded to several items related to planning for the integration of ICT into teaching and learning. Most principals of primary (95%), post-primary (96%), and special schools (97%) indicated that their schools promoted the sharing of good practice in ICT integration among teachers. Most principals also indicated that ICT planning is an integral (rather than separate) part of the overall school planning process (75-83%). Fifty-one percent of principals at primary level, 60% at post-primary level, and 46% in special schools indicated that they used the 'NCTE e-Learning Handbook' and 'Roadmap' in the context of overall school planning. Fifty-eight percent of primary principals, 74% of post-primary principals, and 35% of principals of special schools indicated that their school had a designated ICT-coordinating teacher. Fewer primary, post-primary and special schools had designated ICT-coordinating teachers in 2013 than in 2005 (Figure 5.1).

Figure 5.1: Percentages of primary, post-primary and special schools with a designated ICT coordinating teacher (2005 and 2013)



Use of ICTs

Responding to questions on ICT usage throughout the school, over half of post-primary principals and over one-third of primary and special school principals reported that their schools regularly used content and resources on the local school server to support teaching and learning. Approximately one-quarter of primary school principals, one-fifth of post-primary principals and 12% of special school principals indicated that their school used an external virtual learning environment for this

purpose. Just 10% of primary school principals, 6% in post-primary schools, and 21% in special schools indicated that student-owned computing devices were being used in at least some classes or year groups.

At primary and post-primary levels, the most commonly used assistive technologies were software to support literacy, software to support numeracy, and software applications to support students with disabilities. Special schools indicated use of a much broader range of assistive technologies, including, for example, switches and computer control devices.

Schools reported limited use of ICT tools such as email and video to communicate with other schools in Ireland, with other schools internationally, or with students in another school (for example, sharing subjects). Principals of 7% of primary schools, 25% of post-primary schools, and 11% of special schools said that they collaborated with industry, with larger schools in each sector more likely to report collaboration.

Effects of ICT

Principal teachers were generally positive about the perceived effects of ICT on teaching and learning. Ninety-one percent of principals of primary schools and 89% in post-primary schools and special schools observed an increase in student interest and engagement arising from the use of ICT. Other areas where high levels of change were perceived include the range of methodologies used by teachers, the amount of planning and preparation by teachers, the depth of subject knowledge covered, the level of positive interaction among students during classes, improvements in literacy across the curriculum, improvements in numeracy across the curriculum, and increased ability to meet the needs of lower-achieving students. An area where the impact of ICT was perceived to be weak was meeting the needs of students with special educational needs.

Obstacles to ICT Use

Principal teachers in all school types identified insufficient levels of technical support, age of computing devices, and insufficient time for planning and preparation as being among the most serious obstacles to the effective use of ICT to support teaching and learning (Table 5.1).

Primary school principals also indicated that pressure to cover the prescribed curriculum and insufficient access to ICT for students were significant obstacles. At post-primary level, principals also identified pressure to cover the curriculum, low levels of teacher knowledge of how to use ICT effectively in teaching and learning, and low levels of teacher confidence regarding the use of ICT as obstacles. Principals of special schools also identified insufficient access to suitable ICT-related CPD opportunities as a significant obstacle.

Table 5.1: Rankings of main obstacles to integration of ICT into teaching and learning identified by principals in primary, post-primary and special schools

Obstacle	Primary	Post-primary	Special
Pressure to cover the prescribed curriculum	1	6	
Insufficient levels of technical support	2	2	3
Age of computing devices	3	5	1
Insufficient time for planning and preparation	4	1	2
Insufficient access to high quality broadband	5		4
Insufficient access to ICT for students	6		
A low level of teacher confidence regarding the use of ICT		4	
Insufficient teacher knowledge of how to use ICT effectively in teaching and learning		3	5
Insufficient access to suitable ICT-related CPD opportunities for teachers			6

School-Level ICT Priorities

A number of ICT-related factors to support improvements in teaching and learning were identified as high priority by principal teachers. At primary level, over half of principals identified high-quality broadband connectivity (58%) and Internet safety and related issues (53%) as high priority issues (Table 5.2). Post-primary principals accorded the highest levels of priority to high-quality broadband connectivity (63%), teacher access to ICT equipment to support teaching and learning (62%), Internet safety and related issues (55%), and a high-quality school-wide wireless network (50%). In the special schools sector, teacher access to ICT equipment (64%), high quality broadband (64%), and technical support (61%) were the issues most frequently reported as having very high priority.

Table 5.2: Percentages of principals in primary, post-primary and special schools reporting that various ICT supports are very high priorities for their school, by school category

Priority	Primary	Post-primary	Special School
High-quality broadband Internet connectivity	58.0	63.0	63.6
Internet safety and related issues	52.9	54.8	54.1
Teacher access to ICT equipment to support teaching and learning	47.4	62.3	63.8
Technical support to ensure that ICT equipment is always working	47.4	58.3	61.1
Use of ICT to support students with special educational needs (SEN)	40.1	36.1	76.7
A high quality school-wide wireless network	38.4	50.1	44.9
Improving the capability and speed of the existing “fixed” school network	37.2	49.9	42.9
Access to a range of online tools and application	32.1	37.6	46.5
Use of ICT to improve numeracy across the curriculum	31.2	22.1	49.9
Use of ICT to improve literacy across the curriculum	30.6	26.7	49.3
Student access to mobile computing devices to support learning	27.4	23.1	49.4
Use of ICT to support administration of learning	22.9	48.7	30.4

Teachers' Continuing Professional Development

The most frequently noted priorities for teachers' continuing professional development (CPD) identified by principal teachers at primary level were use of ICT as a teaching and learning tool across the curriculum (47%), use of ICT to support the development of key skills such as literacy and numeracy (43%), and more advanced ICT skills (including blogging, website design, computer programming and other applications) (26%) (Table 5.3). The areas of highest priority at post-primary level were how to use ICT as a teaching and learning tool across the curriculum (including its application to specific subject areas) (66%), how to use ICT to support the development of key skills (e.g., literacy, numeracy) (37%), and use of ICT to support DES priorities (e.g., school evaluation and school improvement) (31%). In special schools, principal teachers highlighted how to use ICT as a teaching and learning tool across the curriculum (49%), how to use ICT to support special educational needs (48%), and how to use ICT to support the development of key skills (36%) as CPD priorities. However, principal teachers in primary and post-primary schools tended to give low levels of priority to CPD on basic ICT skills, digital media skills, the use of ICT to support assessment of learning and assessment for learning, and the use of ICT to support students with special educational needs.

Principal teachers at all levels prioritised ICT-related CPD facilitated by external tutors. Other forms of CPD, such as independent online CPD, online CPD with a school group, informal CPD provided on a peer-to-peer basis, and self-directed CPD, were less well supported.

Table 5.3: Percentages of principals in primary, post-primary and special schools identifying ICT-related CPD content areas among their top three priorities

Content Area	Primary	Post-primary	Special
How to use ICT as a teaching and learning tool across the curriculum (including its application to specific subject areas)	47.1	66.0	48.8
How to use ICT to support the development of key skills (e.g., literacy and/or numeracy)	42.6	36.7	35.7
More advanced ICT skills (including blogging, website design, computer programming and other applications)	25.7	27.8	16.7
Incorporation of ICT for teaching and learning in all CPD provided for teachers (as distinct from ICT-specific CPD)	24.0	27.2	15.5
ICT skills needed to use the school's own equipment (e.g., IWBs, digital projectors, laptops)	23.7	17.6	34.5
The use of ICT to support DES priorities (e.g., school self-evaluation and school improvement)	23.0	30.7	19.0
Digital media skills (including the use of digital video and audio)	21.0	11.7	19.0
Basic ICT skills (including word processing, presentation software and Internet use)	18.7	19.0	9.5
How to use ICT to support assessment for learning	17.8	16.9	9.5
How to use ICT to support assessment of learning	17.4	14.4	14.3
ICT skills needed to use ICT/mobile devices (including those being brought to the school by teachers and/or students)	16.7	16.1	23.8
How to use ICT to support special educational needs	16.6	10.7	47.6

See Tables 5.9, 5.10 and 5.11 in Main Report for further detail.

Internet Safety

Over 90% of schools in each school type reported having an active Internet Safety Acceptable Use Policy (AUP) that guided responsible use of the Internet. Most policies referred to online activities such as searching and browsing websites and uploading and downloading of material, and most mentioned inappropriate, harmful and illegal use of online material. Topics covered less often in AUPs included copyright guidelines and publishing a school website. Across school types, the most common contexts in which students were provided with information on Internet safety were SPHE lessons and lessons in which the Internet was used for teaching and learning purposes.

Conclusion

Between 46% (special) and 60% (post-primary) of principals indicated that they use the 'NCTE e-Learning Handbook' and 'Roadmap' for overall school planning, suggesting that these materials are especially useful. According to principals, 74% of post-primary schools, 58% of primary schools and 35% of special schools had a designated ICT-coordinating teacher. These are lower than the corresponding figures from the 2005 Census – 86%, 75% and 71% respectively – and may be linked to a reduction in senior posts in schools since 2005. The extent to which support for teachers to integrate ICTs into teaching and learning has been affected is unclear.

Principal teachers were mainly positive about the effects of ICT use on teaching and learning, with the vast majority observing an increase in student interest and engagement linked to ICT use. Improvements were also observed in the range of methodologies used by teachers, the amount of planning and preparation teachers engaged in, the depth of subject knowledge covered, and the level of positive interaction among students during classes, as a result of ICT use. Literacy and numeracy were also perceived to have been positively affected. It is encouraging that many principals see positive effects of ICTs given a lack of objective evidence that using ICTs improves learning. The mismatch between current approaches to assessment and ICT-based approaches was evidenced in the lower proportions of principals who observed improvements on standardised test scores and performance on State examinations arising from ICT usage.

At all levels, the most serious obstacles to the effective use of ICT to support teaching and learning were insufficient levels of technical support, age of computing devices, and insufficient time for planning and preparation. Pressure to cover the prescribed curriculum, insufficient access to ICTs for students, insufficient access to high-quality broadband, low levels of teacher knowledge on how to use ICT effectively, low levels of teacher confidence, and insufficient access to suitable ICT-related CPD opportunities were also identified as serious obstacles at one or more levels.

Priorities for teachers' continuing professional development identified by principal teachers at primary level were use of ICT as a teaching and learning tool across the curriculum, use of ICT to support the development of key skills such as literacy and numeracy, and more advanced ICT skills. Highest priority areas at post-primary level included how to use ICT as a teaching and learning tool across the curriculum (including its application to specific subject areas), use of ICT to support the development of key skills (e.g., literacy, numeracy), and use of ICT to support other DES priorities such as school evaluation and school improvement. Special school principals also identified the use of ICT to support special educational needs as a priority. Principal teachers at all levels prioritised ICT-related CPD facilitated by external tutors over other forms of delivery.

6 - COMMENTS OF PRINCIPAL TEACHERS

Altogether, 660 primary school principals (31% of respondents), 130 post-primary principals (26%) and 30 special school principals (33%) availed of the opportunity to provide additional comments on aspects of ICT use in schools. Overall, 1828 comments (i.e., on distinct topics or themes) were made by principals. A content analysis was performed on the comments, with each comment being allocated to one of 16 (or 'other') topics (Table 6.1).

Table 6.1: Distribution of comments made by school principals, by topic

	Primary		Post-primary		Special	
Topic	% of Schools	% of Comments	% of Schools	% of Comments	% of Schools	% of Comments
Funding of ICT Equipment / Resources	45.5	26.8	33.1	17.8	60	27.1
Technical Support / Maintenance	33.9	18.8	35.4	19.6	33.3	17.6
Internet	22.9	10.9	21.5	11.9	20.0	8.2
Professional Development	16.4	7.8	19.2	9.5	30.0	11.8
Teaching and Learning	12.9	7.1	10.0	5.2	10.0	3.5
ICT Study	10.3	5.4	6.9	3.1	13.3	4.7
Computing	9.4	4.8	9.2	4.2	13.3	4.7
Time (Lack of)	9.1	4.9	8.5	4.2	10.0	5.9
Teachers	7.0	3.8	4.6	3.1	13.3	4.7
ICT Coordinator	4.2	2.1	8.5	4.9	6.7	2.4
NCTE/PDST TIE	4.5	2.1	3.8	1.7	3.3	1.2
ICT Planning	2.9	1.2	4.6	2.1	6.7	2.4
Websites	1.7	0.8	4.6	0.7	0.0	0.0
Work in progress	1.5	0.7	6.2	2.8	3.3	1.2
Projects	1.2	0.5	10.0	1.1	0.0	0.0
Network	0.1	0.2	1.5	1.1	0.0	0.0
Other	4.4	2.1	7.7	7.0	13.3	4.7

Number of Comments: Primary = 1457; Post-primary = 286; Special: 85

Most Frequent Comments

The funding of ICT in schools was the topic most frequently commented on by primary and special schools principals, and the second most frequent at post-primary level. Of the comments made, most made general calls for additional financial support for ICT in schools, or made reference to the perceived inadequacy of previous funding. Many respondents said that a lack of funding was the most significant obstacle to the effective integration of ICT into school life. A large number of principals highlighted the inappropriateness of one-off grants for ICT, given the constantly evolving nature of technology. Several principals commented that, in the context of overall reduced funding to schools, improving ICT resources had become increasingly difficult.

Issues relating to technical support and the maintenance of ICT equipment comprised the second most frequently mentioned topic in the primary and special school categories, and the most frequent at post-primary level. Many principals argued that an ICT maintenance grant was required. Several described a lack of, or insufficient access to, technical support. A number of principals' comments called for the provision of centralised technical support for schools. Principals called for

an IT technician to be assigned to individual schools or to clusters of schools. Principals of larger schools, in particular, argued that their schools needed dedicated on-site technical support.

The third most frequent topic in primary and post-primary principals' comments, and the fourth in comments of special school principals, concerned the Internet. The vast majority of comments on this topic expressed dissatisfaction with current broadband service or arrangements. Inadequate broadband service was said to hinder ICT development in schools. Several principals argued that investment in ICT equipment, such as computing devices and interactive whiteboards, is only useful if there is sufficient Internet capacity to support their use. Some principals made direct pleas in their comments to the PDST Technology in Education (formerly NCTE) to improve the broadband service available to their schools. Many principals described their frustration, and the frustration of teachers and pupils, with the poor broadband service available to their schools. Small numbers of post-primary principals expressed satisfaction with recent developments in broadband provision.

Teacher professional development was the fourth most frequently raised topic. Several principals said that training on the equipment available in the school was essential. Others emphasised the desirability of a whole-school approach to CPD, in which all teachers would receive training together. As well as variation in levels of ICT skills across teachers within schools, principals highlighted the between-school variation in skills, which they proposed should be taken into account in the provision of ICT-related CPD. Some principals commented that there was insufficient time available for professional development in the area of ICT.

The fifth most-frequently raised topic related to the use of ICT for teaching and learning. Comments frequently identified the need to integrate ICT into teaching and learning. Some principals reported a perceived need to evaluate the usefulness of ICT as a pedagogical tool, admitting that they were as yet unconvinced of its value for teaching and learning. Other principals, particularly primary-school principals, went further and expressed concern about a possible negative impact of ICT use on aspects of students' learning. A small number of principals suggested that ICT should be integrated further into assessment procedures.

Principal teachers also raised the issue of ICT coordinators. Typical comments described the impact that a lack or loss of an ICT coordinating teacher had on the use of ICT in schools. Many principals said that the ICT coordinator should be made a post of responsibility in all schools. A few called for better professional development for ICT coordinators.

Conclusion

Principal teachers commented most frequently about the funding of ICT in schools, with many calling for additional financial support, or referring to the inadequacy of existing funding. Principals expressed a preference for a more continuous funding stream, rather than one-off grants, as this would allow schools to keep pace with technological developments.

Technical support and maintenance continue to be areas of significant concern for principals, with several funding models suggested, including provision of an ICT maintenance grant and of central technical support for schools.

Principal teachers at all levels highlighted poor Internet access as a significant problem, though there may have been an improvement in this in post-primary schools since the census was conducted.

7 - ICTS IN TEACHING AND LEARNING: DATA FROM TEACHERS

This chapter presents data on teachers' views of ICTs in teaching and learning, based on their responses to the Teacher Questionnaire. As noted in Chapter 3, the low response rates of teachers, and patterns of respondents across schools, mean that care should be exercised in extrapolating the findings to the population of teachers.

Nature of Teaching and Learning

Teachers provided a mixed set of responses to a series of statements about the nature of teaching and learning. What is most striking about these findings, perhaps, is that teachers in all three school types reported very similar beliefs about the nature of teaching and learning. While over 95% of teachers at each level agreed or strongly agreed that their role as a teacher is to facilitate student enquiry, 71% at primary level, 74% at post-primary and 75% in special schools agreed or strongly agreed that instruction should be built around problems with clear, correct answers, and around ideas that most students can grasp quickly. Almost 10% of teachers at primary and post-primary levels, and 11% in special schools disagreed or strongly disagreed that thinking and reasoning processes are more important than specific curriculum content. Teachers in all three sectors reported low usage of projects that take at least one week to complete, debates in which students argue for a point of view which may not be their own, and projects involving members of the community or peers outside the school.

Teachers' Self-Reported Skill Levels

Across all three types of school, teachers reported high levels of skill with the more basic ICT activities, such as using the Internet to find educational resources, word processing, using email, downloading/editing curriculum resources, and organising files into folders (Table 7.1). In general, teachers reported that they were much less familiar or less skilled with tasks associated with 'Web 2.0' tools and social networking. Teachers' levels of skills in working with spreadsheets and presentation software were noticeably lower than their skill levels in using word processing software, email, and the Internet – a finding that may have implications for using ICT in particular curriculum areas, such as mathematics and science.

Access to ICTs by Teachers and Their Students

At each level, at least 90% of teachers reported that they always or often had access to a computing teaching device such as a desktop computer or laptop, with access at primary level almost universal. Access to a digital projector was somewhat higher among teachers at post-primary level (95%) than at primary level (81%) or in special schools (67%). In contrast, teachers in primary schools (87%) and special schools (67%) reported higher access to interactive whiteboards than teachers in post-primary schools (30%). Other equipment, such as visualisers, digital cameras, and video cameras, were more accessible to teachers in primary schools and special schools, than in post-primary schools. Over 90% of teachers in each sector reported that they had access to online resources.

Table 7.1: ICT-related activities ranked as highest and lowest in terms of perceived competence by teachers in primary, post-primary and special schools

	Primary	Post-primary Ranking	Special
Areas of highest perceived competence			
Using the Internet to find educational resources	1	1	2
Communicating with others via email	2	2	1
Producing a simple document using word processing software	3	3	3
Downloading images, software and other files from the Internet	4	4	4
Organising computer files into folders and sub-folders	5	5	5
Downloading and editing of curriculum resources	6	6	6
Areas of lowest perceived competence			
Contributing to an online blog or wiki	19	17	15
Creating and maintaining a website or blog	20	19	19
Using social networking for educational purposes	21	20	21
Using other Web 2.0 tools (e.g., blogs, wikis)	22	22	22
Using a computer programming language	23	23	23

At all three levels, a large majority of students did not have regular access to individual computing devices (i.e., one-on-one access). At primary level, 12% of teachers reported that individual students in their classes often or always had access to a dedicated computing device, while 18% of teachers at post-primary level, and 25% in special schools reported likewise (Table 7.2). At post-primary level, 32% of teachers reported that their students never had access to a shared computing device. Percentages at primary level (15%) and in special schools (8%) were considerably lower.

Just 3% of teachers at primary level, 14% at post-primary level, and 27% in special schools reported that students were allowed to use their own devices (such as tablets, smartphones and cameras) often or always.

Purposes for Using ICTs

The purposes for which teachers reported using ICTs most frequently are consistent with group-based didactic teaching approaches. They included presenting information or giving class instruction to pupils, using curriculum-related online resources for lesson preparation, using applications such as word processing and presentation software to prepare resources for class, and using curriculum-relevant online resources to support teaching and learning. Purposes for which teachers used ICTs less frequently, and which seem more likely to support the development of 21st century skills, included creating podcasts, using a range of media, supporting the development of higher-order thinking skills in students, recording student work for assessment purposes, and using equipment such as digital cameras and digital video (see Table 7.3 for data on most and least frequent purposes). Teachers in special schools reported using ICTs to support students' learning styles, and to differentiate their learning to support the development of literacy and numeracy. Teachers in post-primary and special schools tended to use ICTs more frequently for assessment purposes,

including assessment for learning and assessment of learning, than their counterparts in primary schools, though overall usage levels were modest. For example, 22% of teacher at primary level, 33% at post-primary, and 31% in special schools reported using ICTs often or always to support assessment for learning.

Table 7.2: Percentages of teachers reporting access to 15 types of ICT equipment and resources 'often' or 'always' during class time, by school type

Activity	Primary	Post-primary	Special
I have access to a teaching computing device	98.4	96.2	91.3
I have access to online resources	94.0	92.0	94.2
I have access to an interactive whiteboard (IWB)	87.4	29.7	69.2
I have access to a digital camera	86.7	50.3	88.5
I have access to a digital projector	80.7	94.8	67.3
I have access to a visualiser	60.8	30.8	26.5
Students have access to a shared computing device	51.6	31.7	75.0
I have access to a video camera	50.7	40.9	64.7
My students have access to software and/or applications to meet their learning needs	44.6	41.1	72.8
Students have access to a shared computing device	40.9	44.1	63.5
My students have access to dedicated computing devices to meet their learning needs	40.9	44.1	63.5
In a computer room setting, students have access to a dedicated computing device	25.4	21.6	45.1
Each student has access to a dedicated computing device	12.0	17.7	24.5
Students have access to online resources on their mobile phone devices.	3.4	14.1	27.2
Students may use their own devices (e.g., tablets, smartphones, cameras) to support their learning	3.4	14.1	27.2

Table 7.3: Percentages of teachers reporting most and least frequent uses of ICT for various purposes, during class time and in preparation and planning activities, by school type

Purposes	Primary	Post-primary	Special
Most Frequent Purposes			
Present information or give class instruction to students	80.1	79.7	65.5
Use curriculum-relevant online resources for lesson preparation (e.g., websites, blogs and wikis)	74.6	67.6	67.3
Use applications such as word processing and presentation software to prepare resources for class	72.3	81.1	74.5
Use curriculum relevant online resources to support teaching and learning (e.g., websites, blogs, wikis)	71.6	63.1	66.4
Support the learning of students with special educational needs	51.6	47.0	*

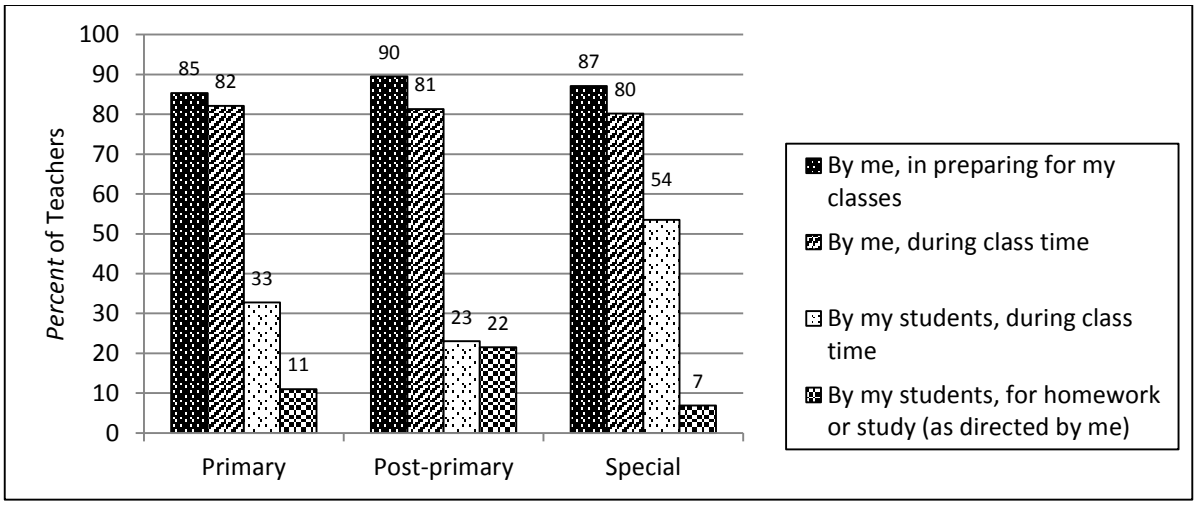
Table 7.3 (contd).

Least Frequent Purposes	Primary	Post-primary	Special
Support student-to-student peer assessment	9.6	21.8	11.8
Post teaching or learning resources on the Internet (e.g., on a blog or wiki) for other teachers or students	7.4	19.6	10.0
Use social networks in teaching and learning	7.2	11.6	9.1
Communicate with students (e.g., email)	3.6	20.0	6.4
Support collaboration between students for learning (e.g., live chat, online forums, school VLE)	3.0	10.9	5.5

**Not asked of teachers in special schools*

Teachers in all school types reported extensive use of ICT by themselves in preparing lessons and in presenting content during class time (Figure 7.1). Student use of ICTs (as reported by teachers) was much less frequent, with just over one-half of students in special schools, one-third in primary schools, and about one-quarter in post-primary schools using ICTs during class time always or often. Use of ICTs for homework as directed by the teacher was reported to be somewhat more frequent among students in post-primary schools than among students in primary and special schools, though usage levels were modest across all school types.

Figure 7.1: Percentages of teachers reporting that they and their students often or always use ICTs for specific purposes, by school type

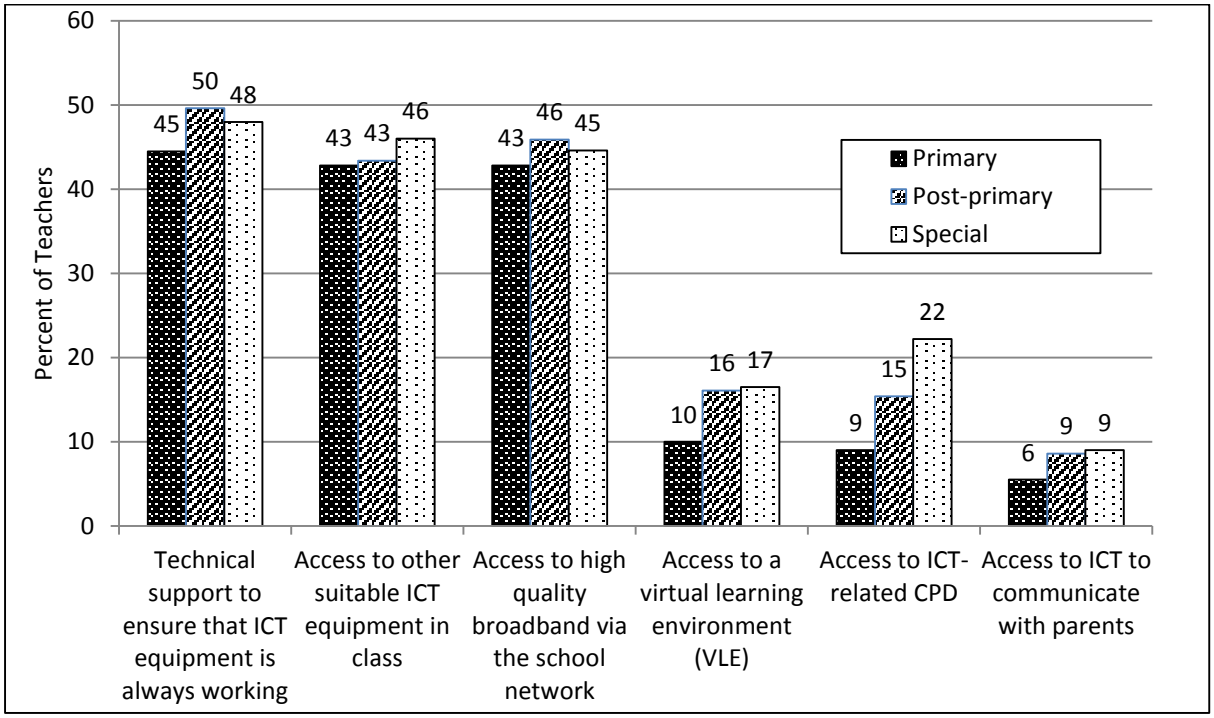


Teachers' ICT-Related Priorities

The three highest ranked ICT priorities for teachers in each sector, with 40-50% according them very high priority, were technical support to ensure that ICT equipment is always working, access to high-quality broadband via the school (fixed) network, and access to high-quality broadband via the school wireless network (Figure 7.2). Between 20% and 30% of teachers in each sector allocated a very high priority to such activities as accessing curriculum-related online digital content/resources, accessing a wider range of online tools and applications, and accessing a dedicated computing device for lesson preparation and for use in class. Marginally fewer teachers in primary and post-primary schools (19%) than in special schools (27%) identified student access to mobile computing

devices as a very high priority. Teachers' priorities (Figure 7.2) are broadly consistent with those identified by principal teachers (Table 5.2).

Figure 7.2: Percentages of teachers reporting that selected ICT activities are very high priority, by school type



For teachers in primary schools, pressure to complete the curriculum was the most serious obstacle to implementing ICTs to support teaching and learning. Insufficient time for planning and insufficient levels of technical support were the second and third highest-ranked obstacles, while blocked access to relevant websites, insufficient access to ICT for students, and age of computing devices also featured in the top six obstacles identified by primary teachers (Table 7.4). These are largely consistent with those identified by principals (Table 5.3).

The highest ranking obstacles identified by teachers in post-primary schools related to lack of time, including pressure relating to the State Examinations, insufficient time for planning and preparation, and timetabling arrangements. Other high-ranking obstacles at this level included difficulties in accessing the computer room, insufficient access to ICTs for students, and blocked access to websites. Insufficient levels of technical support ranked just seventh in this sector.

Teachers in special schools identified blocked access to relevant websites as the main obstacle to using ICTs to support teaching and learning. Insufficient time for planning and preparation and insufficient levels of technical support ranked second and third, respectively. Teachers in special schools also identified as obstacles the age of computing devices (fourth most serious), their own insufficient awareness of suitable digital content (fifth) and their own low levels of ICT skills (sixth). Hence, teachers in this sector were unique in pointing to personal as well as structural obstacles in the use of ICTs to support teaching and learning.

Table 7.4: Rankings of main obstacles to integration of ICTs into teaching and learning identified by teachers, by school type

	Primary	Post-primary	Special
	Teacher Rankings (Top 6)		
Pressure to cover the prescribed curriculum	1		
Insufficient time for planning and preparation	2	2	2
Insufficient levels of technical support	3		3
Blocked access to relevant websites	4	6	1
Insufficient access to ICT for students	5	5	
Age of computing devices	6		4
Pressures relating to State examinations		1	
Timetabling arrangements		3	
Difficulties accessing computer room		4	
Own insufficient lack of awareness of suitable digital content			5
Own low level of ICT skills			6

Teachers' perceptions of the impact of ICTs were largely positive, though there is some variation across areas of teaching and learning, as well as across types of schools. It should be noted that these are not objectively-informed impacts. The most marked impacts were in the areas of student interest and engagement, range of teaching methodologies used, and amount of lesson planning and preparation. A majority of teachers reported no impact on student performance on standardised tests or on other tests.

Continuing Professional Development

At primary level, up to two-thirds of teachers had undertaken CPD in the areas of equipment use (66%), use of ICT as a tool across the curriculum (56%), and use of ICT to support the development of literacy and numeracy (54%) in the two years prior to the survey. At post-primary level, about half of teachers had undertaken CPD in the areas of equipment use and how to use ICT as a tool across the curriculum. CPD undertaken by teachers in special schools was also most commonly reported to involve equipment use (60%) and how to use ICT across the curriculum (41%). Across all three types of school, teachers reported low frequency of participation in CPD involving assessment for and of learning, planning and implementing e-Learning, and more advanced ICT skills (such as blogging, web design and computer programming).

Among the priority areas for CPD identified by teachers at all school levels were using ICT to support the development of key skills (32-47%), more advanced ICT skills (28-37%), using ICT as a tool across the curriculum (38-46%), and ICT skills needed to use the school's own equipment (24-33%) (Table 7.5).

Sharing Digital Resources

Teachers in general responded positively to questions about sharing resources with other teachers. Over 90% in each school category agreed that sharing digital resources can save time and money, and that it can improve the design of resources and the planning involved. A large majority (over 80%) across school types disagreed with the statement that they were reluctant to share resources, or that they did not want others to modify their resources. Nevertheless, a significant minority did not hold positive views on sharing resources, with, for example, 14-25% reluctant to share resources they had spent a long time preparing. At post-primary level, one-quarter of teachers agreed that they did not want others to modify their resources.

Table 7.5: Percentages of teachers choosing each of 12 CPD areas as their first, second, or third priority, by school type

Priority Topic	Primary	Post-primary	Special
How to use ICT to support the development of key skills (e.g., literacy and/or numeracy)	47.1	30.6	32
How to use ICT as a teaching and learning tool across the curriculum (including its application to specific subject areas)	46.3	42.8	38
ICT skills needed to use the school's ICT equipment (e.g., interactive whiteboards, digital projectors, laptops)	33.1	24.4	30
More advanced ICT skills (including blogging, website design, computer programming and other applications)	31.5	37.4	28
Digital media skills (including the use of digital video and audio)	23.5	22.5	20
How to use ICT to support assessment of learning	22.9	15.4	13
How to use ICT to support special educational needs	20.6	18.3	54
How to use ICT to support assessment for learning	19.0	18.5	15
The use of ICT to support Department of Education and Skills priorities/requirements (e.g., school self-evaluation and school improvement)	13.6	28.4	16
Incorporation of ICT for teaching and learning in ALL CPD provided for teachers (as distinct from ICT-specific CPD)	13.5	21.5	22
Basic ICT skills (including word processing, presentation software, and Internet use)	12.8	14.3	10
ICT skills needed to use new ICT/mobile devices (including my own devices and those brought to school by students)	12.7	18.5	20

Conclusion

Despite almost universal support from teachers in all types of schools for the view that their role is to facilitate student enquiry, large proportions felt that instruction should be built around problems with clear correct answers and ideas that most students can grasp quickly. Such views are not consistent with efforts to develop 21st century skills which place a strong focus on solving open-ended problems with more than one solution, and on solving problems collaboratively.

Data provided by teachers support the view that individual or shared access to computing devices by students across levels is insufficient. Thus, while over 90% of teachers at each level had access to a teaching computer often or always, just 12% of primary school teachers, and 18% of post-primary teachers reported student access to a dedicated computing device with the same frequency. The use by students of their own computing devices, including tablets and smartphones, is low in all school types.

The range of purposes for which teachers most frequently use ICT focus mainly on presenting information in class, accessing curriculum-relevant online resources for lesson preparation, and using applications to prepare resources for class. These response patterns are also indicative of a more traditional view of learning, where ICTs are used to strengthen existing teaching and learning practices, rather than as learning tools in the service of 21st century skills.

CPD priority areas for teachers in all school types included use of ICT as a teaching and learning tool across the curriculum (even though a majority of teachers in primary and post-primary schools had attended CPD on this topic in the two years prior to the survey), more advanced ICT skills, ICT skills to use the school's own equipment and ICTs to support the development of skills such as literacy and numeracy. Use of ICTs to support assessment of and for learning was less well supported, as were basic ICT skills such as use of word processing and presentation software.

8 - COMMENTS OF CLASS TEACHERS

Overall, 1091 teachers made 2524 specific comments on aspects of ICT use in schools. At primary level, 1686 comments were made by 765 teachers from 677 schools. At post-primary level, 293 teachers from 202 schools made 669 comments. In the special schools category, 33 teachers from 24 schools made 69 comments. Teachers' comments were grouped into 15 themes (Table 8.1).

Table 8.1: Distribution of comments made by teachers, by topic and school type

	Primary		Post-primary		Special	
Topic	% of Schools	% of Comments	% of Schools	% of Comments	% of Schools	% of Comments
ICT Resources	27.2	14.8	26.2	10.6	25.0	8.7
Teaching and Learning	27.0	13.2	40.1	16.9	50.0	21.7
Teacher Attitudes, Skills and Practices	23.8	11.4	30.7	12	8.3	10.1
Professional Development	21.4	10.3	43.6	16	33.3	11.6
Time (lack of)	17.1	9.1	17.8	6.3	8.3	2.9
Internet	20.2	9.0	13.4	5.2	0.0	0.0
Technical Support and Maintenance	15.4	8.2	16.3	7	12.5	4.3
Funding	14.6	7.1	15.8	6	16.7	7.2
ICT Survey	12.6	5.8	20.3	8.8	33.3	13.0
Websites	5.9	2.4	4.5	1.3	0.0	0.0
Frequency of ICT use	3.4	1.5	4.0	1.2	0.0	0.0
Advisory Support	3.1	1.4	2	0.6	4.2	2.9
Ways in which ICTs are used	3.0	1.3	3.5	1.2	0.0	0.0
ICT Coordinator	2.4	1.0	5.4	1.8	0.0	0.0
Other	7.7	3.4	15.8	5	45.8	17.4
Total Comments	---	100	---	100.0	0.0	100.0

Numbers of Comments: Primary = 1686; Post-primary = 669; Special: 69

Most Frequent Comments

The level of ICT resourcing in schools was the topic mentioned by the greatest percentage of primary school teachers and ranked second among post-primary teachers. The most common comments on this topic related to insufficient ICT resources in classrooms and/or schools. Teachers referred to high pupil-computer ratios and a lack of teacher access to ICT equipment. While they believed that they were expected to incorporate ICT into their teaching, they did not have sufficient resources to do so. Several teachers noted that, in the context of limited ICT resources, use of ICT had become confined to very specific uses, rather than being widely integrated into the educational lives of pupils. Post-primary teachers' referred to difficulties in accessing ICT resources which schools actually have.

ICT as it relates to teaching and learning also attracted comments from relatively large percentages of teachers. Many teachers opened their responses with an acknowledgement of the benefits of ICT use in teaching and learning and several reported that ICT had improved their teaching practice and increased student engagement. Others said that they believed that ICT use would improve their ability to plan and deliver lessons, as well as improve student outcomes, if the necessary resources

were available. A minority of teachers expressed doubts about the value of ICT in teaching and learning, while others noted that a lack of digital resources hampered their ability to integrate ICT into teaching and learning. A shortage of resources in the Irish language was raised.

A third topic raised by teachers related to their attitudes, skills, and practices. Frequently, comments made reference to teachers' own limited proficiency in using ICT, with a number of teachers recognising that their students may miss out due to teachers' limited skills. Teachers also referred to low motivation in relation to incorporating ICT into teaching and learning, and/or low teacher morale impacting on teachers' willingness to do so.

Several teachers across all levels made general appeals for greater opportunities to engage in ICT-related CPD. A need for training on the ICT equipment in classrooms was identified, with some teachers observing that ICT resources were underutilised due to lack of appropriate training. Teachers in special schools called for training in the use of ICTs to address the needs of children with special needs. Teachers across school types argued that, as technologies are constantly and rapidly evolving, training for teachers must be regular to enable them to keep pace with these developments. While some teachers believed that upskilling in relation to ICT was their own personal responsibility, others expressed dissatisfaction with the idea of training in their personal time and at their own personal expense.

Teachers pointed to a lack of time available to plan lessons or prepare resources involving the use of ICTs. Reference was made to time pressures arising from large class sizes and, at primary level, multi-grade classes, as well as time pressure to cover an overloaded curriculum.

A large majority of comments in the Internet category were related to dissatisfaction with current service provision in schools, with many teachers arguing that poor Internet service is the single greatest barrier to increasing ICT use in schools. A number of teachers indicated their schools were now paying privately for Internet provision, as what had originally been provided for their schools was inadequate. A smaller number raised concerns about Internet usage, including cyberbullying and child safety.

Other issues raised by teachers included technical support and maintenance, funding of ICT resources, and the work of ICT coordinators.

Conclusion

While the comments of the vast majority of teachers indicated that they were positively disposed towards the use of ICTs in teaching and learning, many raised issues about access to ICT resources. Teachers also identified a lack of confidence in their use of ICTs, and identified a need for CPD related to the equipment that was available in their classrooms. Poor Internet access and time pressures were also identified as impeding the use of ICTs.

9 - DATA ON USE OF ICTS BY TEACHERS AND STUDENTS FROM INTERNATIONAL STUDIES OF ACHIEVEMENT

Ireland has participated in three major international studies in recent years: the OECD-organised Programme for International Student Assessment (PISA), which has been administered to representative national samples of 15-year olds in Ireland on five occasions since 2000 (most recently in 2012); the Progress in International Reading Literacy Study (PIRLS), organised by the International Association for the Evaluation of Educational Achievement (IEA), which was administered to students in fourth class in Ireland in 2011; and the Trends in International Mathematics and Science Study (TIMSS), also sponsored by the IEA, which was administered to the same students in 2011. Data from the three studies were drawn on to provide a broader context for interpreting ICT usage in classrooms in Ireland.

Student Achievement in an International Context

In general, students in Ireland had mixed results in recent international studies. In PIRLS 2011, students in fourth class in Ireland ranked 10th of 45 countries, with just five countries (Hong-Kong, Russian Federation, Singapore, Finland and Northern Ireland) achieving significantly higher scores (Eivers & Clerkin, 2012). In TIMSS 2011 Mathematics, students in fourth class in Ireland achieved a ranking of 17th, with 13 countries achieving significantly higher scores (ibid). In TIMSS Science, students in fourth class in Ireland ranked 22nd, with 17 countries achieving significantly higher mean scores (ibid). In PISA 2012, 15-year olds in Ireland achieved mean scores that were significantly higher than the corresponding OECD average on paper-based reading, computer-based reading, paper-based mathematics and paper-based science (Perkins et al., 2013). Irish students achieved mean scores that did not differ significantly from the corresponding OECD averages on computer-based mathematics and on computer-based problem solving (OECD, 2014; Perkins & Shiel, 2014). Ireland's rankings ranged from 7th of 65 on print-based reading to 20th of 32 on computer-based mathematics.

ICT Use

Findings from PISA 2012, based on a questionnaire about ICT usage administered to students who sat the paper- and computer-based tests, show that there is significant underuse of ICTs by students in post-primary schools in Ireland. Over one-third of 15-year olds reported that, although a computer was available at school, they did not use it (Table 9.1). The corresponding average for OECD countries is 23 percent. Internet usage in post-primary schools was below OECD average levels, with 45% of 15-year olds in Ireland reporting that they never make use of it. The corresponding OECD average is 36 percent.

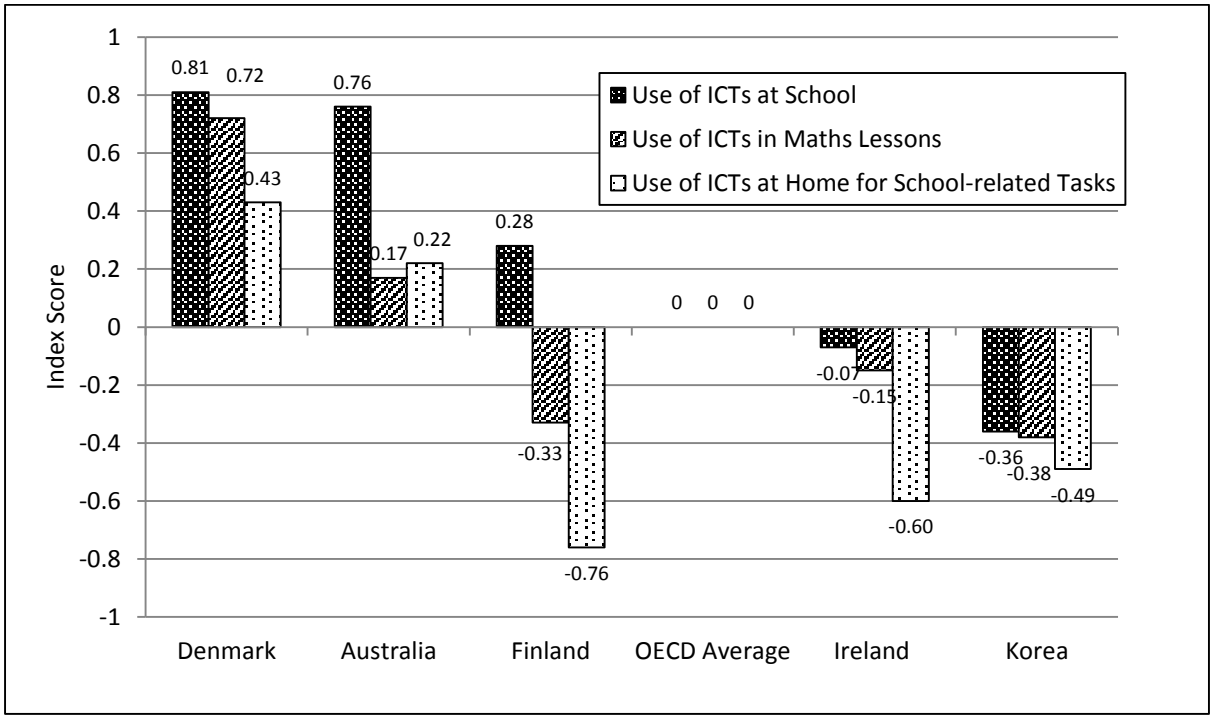
Among 15-year-olds in Ireland, use of ICTs at school in general, in maths lessons, and at home for school-related tasks were all below the corresponding OECD average levels (Figure 9.1). While Finland, which performed consistently well in all domains assessed, had a higher mean score than Ireland on general use of ICTs at school, it had a lower score on use of ICT at home for school-related tasks such as homework. Students in another high-scoring country, Korea, reported low ICT usage on each of the three indicators.

Table 9.1: Availability and usage of ICT devices by students <u>at school</u> (PISA 2012), Ireland and OECD average

	Yes, and I Use It	Yes, but I Don't Use It	No
Desktop Computer			
Ireland	61.4	33.5	5.2
OECD Average	64.4	23.3	12.1
Portable laptop / notebook			
Ireland	12.1	20.1	67.8
OECD Average	26.2	16.3	57.5
Tablet			
Ireland	3.5	5.0	91.5
OECD Average	5.5	6.0	88.5
Internet Connection			
Ireland	61.4	31.5	7.1
OECD Average	70.7	18.9	10.5
Printer			
Ireland	59.2	36.1	4.7
OECD Average	57.9	26.5	15.6
USB Stick			
Ireland	25.3	28.2	46.5
OECD Average	30.2	19.7	50.1
E-books			
Ireland	2.4	6.3	91.3
OECD Average	4.5	8.4	87.1

Source: PISA 2012 database

Figure 9.1: Mean scale scores on PISA 2012 indices of Use of ICTs at School, Use of ICTs in Maths Lessons, and Use of ICTs at Home for School-related Tasks by 15-year olds, Ireland, OECD average and selected OECD countries

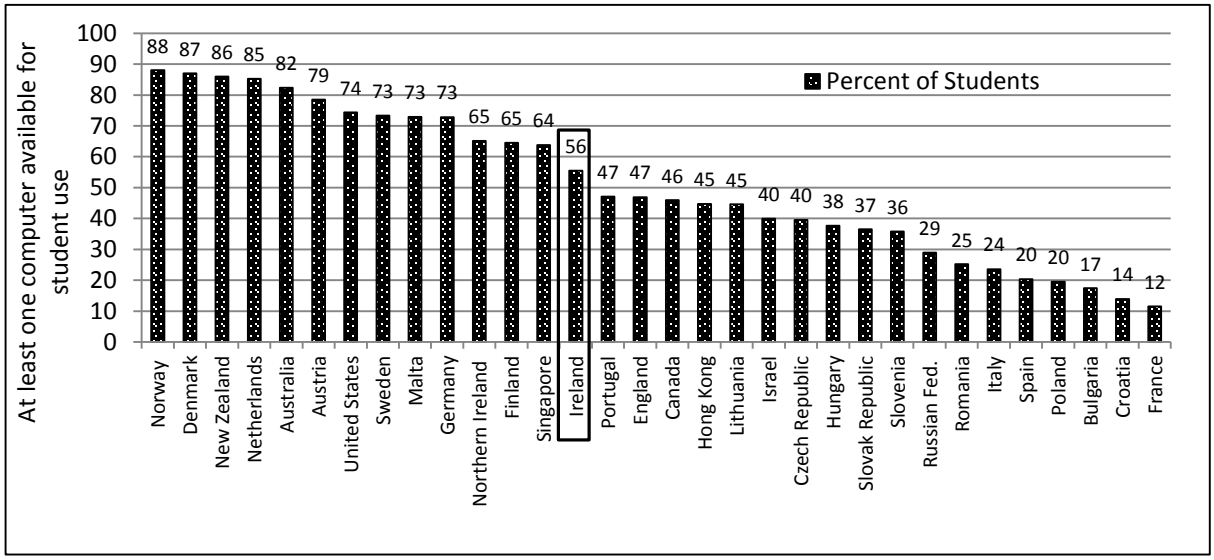


Source: PISA 2012 database

Fifteen-year olds in Ireland were less likely than on average across OECD countries to report engaging in higher-level ICT tasks at home, such as reading news on the Internet, obtaining practical information from the Internet, or using email.

Figure 9.2 shows the percentages of pupils in PIRLS 2011 whose teachers reported that at least one computer was available for pupil use during reading lessons. A noteworthy feature of the data is the large percentages of pupils (85%+) with access to computers in Norway, Denmark, New Zealand and the Netherlands. Ireland, where just 56% of pupils have access to computers during reading lessons, lags well behind these countries.

Figure 9.2: Percentages of pupils whose teachers reported that at least one computer was available for pupil use during reading lessons: Selected PIRLS 2011 countries and PIRLS international average



Source: PIRLS 2011 database

In PIRLS 2011, computer use by pupils in schools in Ireland where there was at least one computer available for use was less frequent for such activities as using instructional software to develop reading skills and strategies, and using the computer to write stories, than on average across PIRLS 2011 countries. Likewise, TIMSS 2011 data for pupils in fourth class shows that only limited use is made of computers in mathematics classes in Ireland and very limited use in science classes in primary schools.

On average, teachers of pupils in fourth class in Ireland were more comfortable in using computers in their teaching than their counterparts across PIRLS 2011 countries. However, teachers in Ireland identified more limited access to computer staff in schools to address technical problems, and lower levels of support for integrating computers into teaching and learning activities.

Conclusion

While Irish students do reasonably well on international studies of educational achievement such as PIRLS, TIMSS and PISA, data on ICT usage gathered from students and teachers in those studies point to areas in which Ireland lags well behind other countries. These include the use by 15-year olds of computers at school, in mathematics lessons, and at home for school-related tasks. At primary level, Ireland lags well behind countries such as Norway, Denmark and New Zealand in terms of pupils' access to computers during reading lessons, and, where computers are available, the range of literacy-related activities in which pupils engage. Similarly, at primary level, limited use is made of computers in mathematics lessons, and, especially, in science lessons.

10 - OVERALL CONCLUSIONS

In this chapter, conclusions from the 2013 ICT Census of Schools are drawn. These are considered in the context of international developments in technology, together with the National Digital Strategy (NDS) which aims to help Ireland to reap the full rewards of a digitally enabled society (DCENR, 2013) and efforts to develop key skills in the education system (DES, 2011, 2012a). The conclusions lead to recommendations designed to contribute to the development of a Digital Strategy for Schools.

The chapter is organised around three broad themes that mirror those in Chapter 2: *ICT Infrastructure; Learning, Teaching and Assessment through the Use of ICT*; and *Teacher Professional Learning*. A fourth theme, *Research, Policy and Leadership* is added. Within these broad themes, eleven subthemes are addressed, as outlined in Table 10.1.

Table 10.1: Themes and subthemes addressed in conclusions

Broad Theme	Subtheme
ICT Infrastructure	Internet Connectivity Access to Computing Devices and Other Technologies Technical Support and Maintenance Purchasing and Procurement
Learning, Teaching and Assessment Using ICT	Use of ICT in Teaching and Learning Developing 21st Century Skills Using ICT Assessment and ICTs
Teacher Professional Learning	Specifying Teacher Professional Knowledge Supporting Teacher Professional Learning
Research, Policy and Leadership	Research as a Driver of Policy and Practice School Leadership and Planning

It should be noted that the themes and subthemes are not presented in order of importance. Furthermore, success in implementing change in relation to one theme or subtheme will depend on developments relating to other themes/subthemes. For example, a new technological initiative, such as high-speed broadband, would seem to have a limited chance of success in the absence of adequate technical support, pedagogic support for teachers, and research to identify strengths, weaknesses and effects (see UNESCO, 2008a, 2011a).

ICT Infrastructure

Infrastructure includes resources such as computer hardware, data and networks, information resources, interoperable software and technical support. This section focuses on four specific issues that have been prominent in both the literature review and the results of the 2013 ICT Census of Schools: Internet connectivity, access to computing devices and other technologies, technical support and maintenance, and purchasing and procurement.

Internet Connectivity

The national rollout of 100 Mbps Internet connectivity to all post-primary schools is a welcome move, but, as noted in the literature review, as the broadband requirements associated with many

applications continue to rise, 100 Mbps may soon be inadequate. In the USA, for example, it has been estimated that speeds of up to 10 Gbps per 1000 students may be necessary within the next five years (Fox et al., 2013). To ensure adequate connectivity, the Digital Strategy for Schools should seek to estimate the broadband needs of schools of varying size and location, including primary and special schools, with a view to ensuring that all schools will have adequate broadband speeds to meet their current and future needs.

While bringing high-speed broadband to all schools is an important policy priority, it is also important to ensure that school broadband networks, whether fixed or wireless, operate in a way that maximises the benefits of available broadband width. Hence, the Strategy should also deal with how schools can be supported in distributing available bandwidth to maximum effect in a context in which greater numbers of teacher and student devices will be in use, access to cloud computing will increase, and networks may have to accommodate increased broadband speeds over time.

Access to Computing Devices and Other Technologies

The 2013 Census provides evidence that schools and teachers are relatively well-resourced to use ICTs in preparing for and presenting lessons (with funding for this being provided in recent years). In contrast, it highlights the fact that students are poorly resourced in terms of having access to and using computing devices, especially in classroom settings. This, in turn, suggests a current focus on ICTs to support didactic as opposed to constructivist and hands-on teaching and learning activities. In PIRLS 2011, just over one half of students in fourth classes in Ireland were in classrooms in which at least one computing device was available for student use during reading lessons. This is compared with 85% or more in Australia, Denmark, the Netherlands, Norway, and New Zealand, and suggests that students in Ireland have insufficient access to computing devices in their classrooms at school.

The Digital Strategy for Schools, in keeping with international practice, should set national targets for the ratio of students to computing devices, with an overall aim of achieving one-to-one computing. Schools should be supported in deciding on the most appropriate blend of fixed computers, school-owned portable devices, and student-owned devices. Such decisions need to take into account changing curriculum priorities and expectations, the location and socioeconomic contexts of schools, and concerns that schools and parents may have about Internet safety when student-owned devices are in use. The Strategy should also seek to ensure that all teachers have access to computing devices that will support their professional activities, both at school and at home.

The Strategy should also address the issue of ageing computing devices. The 2013 Census indicates that approximately 40% of computing devices in primary and special schools and 20% in post-primary schools are more than six years old. Principals of special schools rate ageing computers as the most serious obstacle to using ICTs to support teaching and learning, while their counterparts in primary schools rate it as the third most serious obstacle.

The Strategy should also consider recent advances in cloud computing, and their relevance for schools, since schools could save on procurement and maintenance of local servers by sourcing software and web applications that are cloud-based. Cloud computing could host a range of services including digital textbooks, digital libraries, simulations, virtual learning environments, text processing, audio/video capture, programming platforms, and a host of administrative functions, with teachers and students accessing relevant data at school and at home. However, privacy and

security issues need to be rigorously addressed as part of a Digital Strategy in relation to the use of cloud computing.

Technical Support and Maintenance

Several earlier reports, including *ICT in Schools* (DES, 2008), *Investing Effectively in Information and Communications Technology in Schools* (DES, 2008), and *Smart Schools = Smart Economy* (ICT in Schools Joint Advisory Group to the Minister for Education and Science, 2009), highlighted an urgent need to address the provision of technical support in schools. The 2013 Census indicates clearly that technical support and maintenance continue to be significant issues for schools and teachers. The Digital Strategy for Schools should put forward clear and specific proposals with clear targets for an integrated, system-wide approach to technical support and maintenance. Without this, schools are highly unlikely to successfully integrate ICTs into teaching, learning, and assessment on an ongoing and sustained basis.

Purchasing and Procurement

The Digital Strategy for Schools should underline the importance of using procurement frameworks such as those developed by the PDST-TIE, so that the advantages of bulk buying and multi-year support contracts can be leveraged, and some level of standardisation in ICT resources across schools can be achieved. The Strategy should also examine how procurement frameworks could be modified or broadened so that teacher professional learning and technology management are linked to investment in infrastructure, whether at national or school level.

Learning, Teaching and Assessment Using ICTs

In this section, the focus is on the use of ICTs in teaching, learning and assessment. Ways in which the development of 21st century skills can be promoted through ICT usage are also considered.

Use of ICTs in Teaching and Learning

Although teachers in the 2013 Census were strongly supportive of constructivist-based views of teaching and learning, they indicated equally strong preferences for traditional practices. As noted in Chapter 2, if teachers are traditional in their pedagogical practices, the technology will be used in traditional ways. This argument receives support in the findings on infrastructure in the Census, which indicate that, where schools were relatively well-resourced with respect to interactive whiteboards, these were used extensively by teachers. Where students had low levels of access to computing devices, they tended not to use them very much in teaching and learning contexts. Consequently, the design of teacher professional learning programmes cannot centre on the use of the technology in isolation. Teachers need to understand the use of digital technologies embedded within new pedagogical practices. The design of successful teacher professional learning programmes necessitates an understanding of the complex interaction of changing teachers' beliefs and practices as well as the introduction and use of digital technologies

The 2013 Census identified varying levels of (self-reported) skills among teachers in completing ICT-related activities. Teachers claimed moderate to high average levels of proficiency in producing simple documents using word processing software, communicating via email, using the Internet to find educational resources, downloading and editing curriculum resources, and creating a

presentation incorporating video or audio. However, their average skill levels varied between basic and moderate for participating in an online social network or forum, using digital video recording, using social networking for educational purposes and using other Web 2.0 tools such as blogs and wikis. These data suggest that many teachers are likely to lack the knowledge and skills to implement ICTs effectively in ways that engage and challenge students, an issue that needs to be addressed as part of the Digital Strategy for Schools.

Teachers' confidence levels in using ICTs in teaching and learning may also be a problem. This was underlined in the Census by school principals, when, for example, principals of post-primary schools ranked low teacher confidence in using ICTs as the fourth most serious obstacle to using ICTs to support teaching and learning (just below low levels of teacher knowledge). Low confidence levels may discourage teachers from trying out new ideas in the classroom, and from engaging in online professional development activities that would further enhance their knowledge.

While some of the impetus for incorporating ICTs into teaching and learning will come from curriculum change (for example, it is envisaged that ICTs will play a significant role in the new Junior Cycle programme and in revised subjects at Senior Cycle) as well as changes in assessment, the Digital Strategy for Schools should emphasise how ICTs can be incorporated into each curriculum area, and how they can serve to establish links across aspects of the curriculum. The Strategy should also address how approaches to developing literacy and numeracy across the curriculum, in line with the *National Strategy to Improve Literacy and Numeracy Among Children and Young People 2011-2020* (DES, 2011), can be supported through the use of ICTs in revised curricula at both primary and post-primary levels.

Developing 21st Century Skills Using ICTs

Reference has been made in this report and elsewhere to key skills or competencies associated with learning in the 21st century – creativity, innovation, collaboration, critical thinking, communication, problem solving, self-regulation and the effective use of ICTs. It is claimed that these skills are becoming increasingly more important as we move towards a more globalised and technology-driven economy (Binkley et al., 2012; Partnership for 21st Century Skills, 2007, 2008). Moreover, students should be able to use them across a range of applied or real-life contexts as they develop as engaged thinkers, global citizens, and active learners in collaborative social environments.

There is evidence that students in Ireland lack key 21st century skills. In PISA 2012, Irish 15-year-olds achieved a mean score on a computer-based assessment of creative problem solving that was not significantly different from the corresponding OECD average and a ranking of 22nd among 44 participating countries (OECD, 2014). The key challenge would appear to be translating aims and objectives in curricular frameworks into teaching and learning activities that allow for the development of these kinds of skills consistently over time. The research suggests that teachers can support the development of '21st century' or 'knowledge creating' and 'knowledge deepening' skills as well as more basic technology literacy (UNESCO, 2008a) through a range of pedagogies, which leverage a range of ICTs. Teachers need professional learning opportunities to consider and reflect on the variety of theoretical and pedagogical models underpinning these ideas and, crucially, how they can be translated into their own teaching, learning and assessment.

The Digital Strategy for Schools should provide a clear outline of how ICTs can promote the achievement of goals relating to 21st century learning skills, both within curriculum/subject areas and across the curriculum. The *Framework for the Junior Cycle* (DES, 2012a) enumerates a set of eight key skills (literacy, numeracy, managing myself, staying well, communication, being creative, working with others, and managing information and thinking), and envisages a key role for ICTs in achieving each skill. The NCCA (2008) has issued a key skills framework for Senior Cycle that includes creative and critical thinking, information processing, communicating, being personally effective, and working with others. As noted in Chapter 2, the achievement of "21st century skills" will be contingent on embracing new approaches to teaching, learning and assessment, within a context in which ICTs play a key role. With this in mind, the Strategy should clearly distinguish between ICT-based activities that are likely to lead to knowledge acquisition and ones that are more likely to promote 21st century skills through knowledge deepening and knowledge creation.

Assessment and ICTs

The specification of 21st century goals within and across curriculum areas, together with a shift in focus from knowledge acquisition to knowledge deepening and knowledge creation, has implications for assessment. It is no longer sufficient to focus on assessing a narrow range of skills for summative purposes. The next generation of assessments needs to measure those 21st century skills that are deemed to be essential for students' future lives. Moreover, the focus of assessment needs to shift from summative to formative, providing information which teachers can draw on continuously to improve students' learning, and in which feedback of results forms an integral part of the assessment process. Students' assessment of their own and each other's work will also play a key role.

The 2013 Census suggests that teachers in Ireland have been slow to embrace ICT-driven assessment tools. For example, over 80% of teachers in post-primary and special schools, and 90% in primary schools, reported that their students never gathered evidence of learning using an e-portfolio approach. Similarly, 80% of teachers in primary and post-primary schools, and 70% in special schools reported that they never administered a digital test. Teachers' lack of engagement with digital assessment arises for a range of reasons including lack of access to relevant tests, lack of infrastructure in schools, and the emphasis on paper-based assessments in state examinations.

The Digital Strategy for Schools should provide guidance on the range of electronic assessments that are already available. Particular attention should be paid to formative assessments that provide teachers and students with feedback that can guide learning in their classes, while also informing instructional decisions at school level. The Strategy should also highlight the potential of ICT for self-assessment, peer assessment, and adaptive comparative judgement, as well as integrated teaching, learning and assessment systems that focus on relevant 21st century skills.

Teacher Professional Learning

Teacher professional learning is a key driver of the integration of ICTs in teaching, learning and assessment. This section looks at two key aspects: the nature of teacher professional knowledge and approaches to promoting teacher professional learning.

Specifying Teacher Professional Knowledge

As outlined in Chapter 2, the *UNESCO Competency Framework for Teachers* provides a useful overview of the knowledge and skills that teachers should acquire, and the learning experiences that students should engage in, as efforts to integrate ICTs into teaching, learning and assessment move forward.

Based on the outcomes of the 2013 Census, as well as data on ICT usage from international studies such as ESSIE, PISA and PIRLS, it can be concluded that, in general, a large majority of teachers in Ireland currently focus mostly or exclusively on the *technology literacy* approach. Even within that approach, there is wide variation, with most teachers using ICTs for lesson preparation and presentation, and some successfully engaging students in ICT activities that support and, in some cases, extend more traditional approaches to teaching and learning.

Within its lifetime, the Digital Strategy for Schools should seek to support teachers to move towards the knowledge deepening and knowledge creation approaches. If the Strategy sets out to achieve this, it will need to spell out implications for:

- Teacher professional learning (see next subsection).
- Curriculum development.
- The organisation of teaching and learning in classrooms.
- The nature of assessment (formative and summative) that focuses on complex problem-solving and other 21st century skills.
- The range of ICTs/technological tools and their purposes, including those best suited to knowledge deepening and knowledge creation approaches.

In this context, the Strategy should serve as an important reference source for those involved in curriculum development and the preparation and development of teachers ahead of implementing new curricula and syllabi.

Supporting Teacher Professional Learning

Principal teachers in the 2013 Census in post-primary and special schools highlighted insufficient teacher knowledge on how to use ICT effectively in teaching and learning as a key obstacle to using ICT. Principals in post-primary schools also identified low levels of confidence among teachers in using ICTs. Principals in all three school categories identified how to use ICT as a teaching and learning tool across the curriculum (including its application to specific subject areas) as their top priority for teacher professional learning, while principals in special schools also identified the use of ICTs to support students with special educational needs as important.

There is need for a clear rationale underpinning teacher professional learning across the continuum which is not confined to the development of ICT skills but includes all policy initiatives. Otherwise, professional learning programmes can lack direction and lead to maintenance of the status quo and a continuing reinforcement of existing beliefs and practices. Without a questioning of basic assumptions about learning and teaching, it is not possible to determine what is valued or important in a particular culture. For example, interactive computer simulations, open educational resources, and sophisticated data-gathering and analysis tools are some of the resources that enable teachers to provide previously unimaginable opportunities for conceptual understanding (UNESCO, 2008a).

However, use of these tools needs to be grounded within a particular teaching, learning and assessment context that is related to defined national policy priorities if they are to change classroom practice and the roles of teachers and students.

The design of teacher professional learning is also very important. For example, consideration needs to be given to the extent to which teacher professional learning should be tailored to the contexts of specific schools and groups of teachers and learners. The idea of 'build it and they will come' is not a stable rationale to inform a professional development policy. For example, it is not enough to provide a "learning portal". Deep consideration has to be given to what types of resources are on learning portals and, more importantly, the model of teaching and learning they support. Are they designed with all teachers in mind or are they organised into meaningful categories geared to more specific needs and topics? Who develops the resources and is there the facility for teachers to change and adapt them and repost them for others to use? Do teachers discuss how they use these resources and offer support to each other? Are communities of practice encouraged and supported on these portals? While there may be collaboration and sharing within these emerging communities of practice, there needs to be a questioning of the learning rationale/foundation underpinning these communities. Are they built on traditional understandings of learning? Or, if the participating teachers are moving into the knowledge deepening and knowledge creation stages (which require significant transformation of understandings of learning), how are they supported? The answers to these questions will be influenced by the policy decisions that are taken, what is driving these decisions and how funding is subsequently allocated. Similarly, there needs to be a connection between infrastructural development and teacher professional learning to ensure that any funding is leveraged to its potential. It is accepted that without coordinated integrated plans to support implementation, equipment often remains underused in schools (Bakia et al., 2001).

The US National Education Technology Plan (NEPT, 2010) is an example which outlines a view of teaching as *connected teaching,* that is, teachers "are supported individually and in teams by technology that connects them to data, content, resources, expertise, and learning experiences that can empower and inspire them to provide effective teaching for all learners" (p. 39). The US-based view of the role that ICT can play in supporting teachers' development throughout their careers is broadly consistent with recent (Irish) Teaching Council documents (e.g., Teaching Council, 2011a, 2011b), which prioritise the role of ICT in initial and continuing teacher development, and recognise the growing role of new technologies and social media in how young people learn.

The Digital Strategy for Schools can build on these developments by promoting a view of teacher professional learning that:

- Reinforces the concept of a continuum of professional learning extending from preservice through induction, mid-career and beyond.
- Enables preservice teachers to experience technology-supported learning, assessment and instruction in all their courses.
- Supports the establishment of ICT standards for teachers.
- Enables teachers to engage in planning their own ICT-related professional development and in evaluating their own competence in using ICTs in teaching, learning and assessment.
- Supports teachers in moving from technology literacy through knowledge deepening and knowledge creation.

- Supports the development of online learning modules that address the needs of individual teachers and groups of teachers (for example, subject departments) with differing sets of competencies.
- Ensures that teacher professional learning is an integral component of all new ICT initiatives, such as the provision of high-speed broadband to schools.

In short, what is needed is a connected approach to professional learning that is "collaborative, coherent, and continuous" (NETP, 2010, p.10).

Research, Policy and Leadership

This section deals with two further drivers of change in the use of ICTs in education – research as a driver of policy and practice, and school leadership and planning.

Research as a Driver of Policy and Practice

A significant factor impeding the integration of ICTs in teaching, learning and assessment is the lack of research information on the effects of the various ICT initiatives that have been implemented in recent years, both centrally, through funding by the Department of Education and Skills, and by other organisations and individuals. The availability of such information might help convince teachers and others of the benefits of ICTs in teaching and learning. It might also support the efforts of school leaders seeking to encourage staff to innovate and change traditional teaching practices. Although large majorities of principal teachers across all school categories in the 2013 Census indicated that ICTs had impacted positively on the range of methodologies used by teachers, students' levels of interest and engagement, and performance in literacy and numeracy across the curriculum, no collaborating evidence is available to back this up.

The Schools Integration Project (SIP), an initiative implemented in Ireland in the early 2000s, supported innovative activities relating both to technology and to learning using ICTs through a combination of public and private funding. However, the evaluative component of SIP was weak, and it can be argued that this worked against justifying the extension and upscaling of the most successful aspects of the project. Other efforts to evaluate projects have not always been well-planned. For example, no baseline data on the uses or effects of ICTs on teaching and learning were gathered in the 78 pilot schools involved in the 100 Mbps Connectivity Demonstration Programme (DES, 2012b), nor was a suitable comparison group of schools selected, making it difficult to identify programme effects at a later stage. The Economic, Social and Research Institute (ESRI) is currently conducting a study titled 'The Effects on Teaching and Learning from Ireland's 100 Mbps Broadband Scheme for Post-primary Schools', which is examining how broadband provision impacts on teaching and learning in 200 schools.

International research (e.g., OECD, 2010) has pointed to the value of a systemic approach to the implementation of new initiatives. Such an approach should create a feedback loop that would contribute to the refinement of existing policy and to future policy development.

In relation to research and innovation, the Digital Strategy for Schools should:

- Emphasise the value of conducting pilot studies prior to full-scale implementation of new initiatives, so that potential problems in implementation can be identified in advance and addressed.
- Emphasise a rigorous research-based approach to implementing all publicly-funded initiatives and disseminate and act on findings.
- Support the provision of competitive grants for implementation of innovative and evidence-based programmes that are not initiated centrally, but meet ICT policy priorities, and ensure that such programmes are carefully evaluated, with a view to upscaling the most successful ones.
- Ensure that project evaluations examine the effects of innovations on teacher knowledge and teacher professional learning, as well as on student learning.
- Disseminate information about the effects of integrating ICTs in teaching and learning.
- Support colleges of education and other organisations in establishing an orientation towards research among school leaders and teachers.
- Engage with the international community to improve the collective understanding of how best to implement ICT in education and support teachers and students in acquiring the skills required to teach and learn with technology.

School Leadership and Planning

Principal teachers play a key role in promoting the use of ICT in teaching and learning. Furthermore, buy-in from school leadership is a critical ingredient of successful ICT-based initiatives, along with thoughtful planning, relevant teacher development, and support from teachers and students. The NCTE (2009) handbook, *Planning and Implementing e-Learning in Your Schools*, is further testimony to the key role that principal teachers can play in interpreting national policy and facilitating change at school level.

The analysis of the 2013 Census data provides an overview of the role played by principal teachers in schools in Ireland. Principals rated 18 ICT-related activities in terms of the priority they allocated to them for improving teaching and learning. Across all school categories, principals allocated highest priority to infrastructure-related activities, including accessing high-quality broadband Internet connectivity, accessing ICT-related equipment, improving the capability and speed of the existing fixed school network, and ensuring a high-quality school-wide wireless network. Principals also allocated a high priority to addressing Internet safety issues. In contrast, lower priority was assigned to teacher use of ICTs for teaching, learning and assessment, including access to a range of online tools and applications, use of ICT to develop higher-order thinking, and access to curriculum-related online content. These findings indicate a need to address the balance between acquiring improved infrastructure and ensuring Internet safety on the one hand, and supporting teachers to make the best use of available ICTs in the service of teaching, learning and assessment, on the other. However, as long as inadequate infrastructure remains a problem, it will remain difficult to address teaching, learning and assessment.

While principals across all school categories allocated the highest priority for CPD to using ICT as a teaching and learning tool across the curriculum, some had a narrow view of what this entails. For example, the use of more advanced ICT skills (including blogging, website design, computer

programming and other applications), and the use ICT to support assessment for learning, were accorded relatively low priority. It may be that principals are not fully aware of the potential of Web 2.0 applications to support both student and teacher learning, including assessment for learning. Principals' preference for more traditional CPD involving an external facilitator, compared with more interactive, web-based and informal approaches, also suggests a lack of familiarity with the potential of these less-traditional approaches.

The Digital Strategy for Schools should ensure that principal teachers are supported so that they can in turn support and lead on the use of ICT in teaching, learning and assessment in schools. The Strategy should:

- Highlight the key role of the principal and other school leaders in formulating and implementing ICT policy at school level, and in supporting teachers and students in their use of ICT.
- Provide specifically-focused CPD for principals on how ICT can enhance teaching, learning and assessment at school level, ensuring a good balance between providing and maintaining infrastructure, while supporting teaching and learning.
- Encourage principals to explore non-traditional approaches to providing opportunities for teacher professional learning in a context in which teachers are expected to take greater responsibility for their own professional learning.
- Outline how school ICT co-ordinators can support teachers and students in using ICT in teaching, learning and assessment.
- Ensure that principal teachers and ICT co-ordinators play a key role in implementing and evaluating the effects at school level of all new publicly-funded ICT initiatives, including those focusing on teaching, learning and assessment.

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