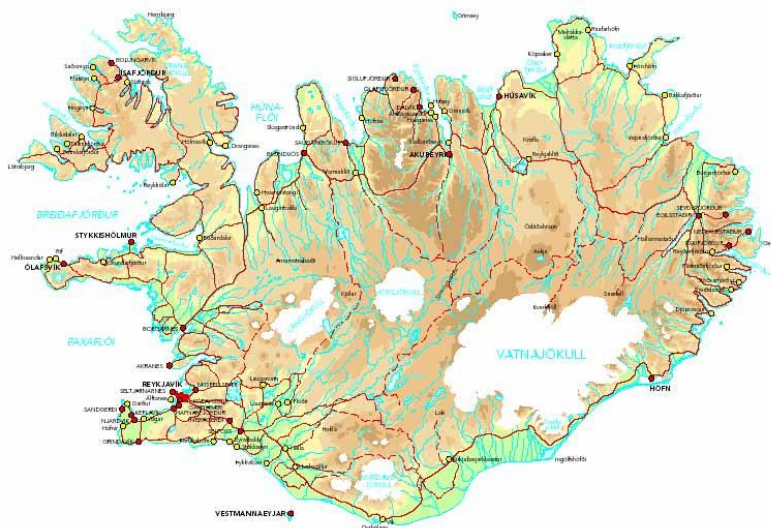


OECD/CERI PROJECT

DIGITAL LEARNING RESOURCES AS SYSTEMIC INNOVATION

BACKGROUND REPORT

ICELAND



<http://www.scantours.com/Maps/images/iceland.jpg>

Reykjavík
December 2008

OECD/CERI PROJECT
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BACKGROUND REPORT
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August 2008, December 2008

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This report was prepared by Allyson Macdonald (national coordinator of the DLR project in Iceland) for the Ministry of Education, Science and Culture in cooperation with Sigurjón Mýrdal, Head of Division, Ministry of Education, Science and Culture and with support from the working group for the project in Iceland, members of which were Guðbjörg Sigurðardóttir (The Information Society, Office of the Prime Minister), Jóna Pálsdóttir (Ministry of Education, Science and Culture), Björg Pétursdóttir (Ministry of Education, Science and Culture), Sigurbjörg Jóhannesdóttir (Ministry of Education, Science and Culture), Sigurður Davíðsson (Ministry of Education, Science and Culture), Sólveig Jakobsdóttir (University of Iceland, formally Iceland University of Education) and Þuríður Jóhannsdóttir (University of Iceland, formally Iceland University of Education).

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FOREWORD

In 2007 OECD/CERI initiated a project entitled *Digital learning resources as systemic innovation* (OECD, 2007).¹

The aim of this activity has been to review and evaluate the process of innovation involved in policies and designed to promote the development, distribution and use of digital learning resources (DLR) for the school sector. Instead of focusing on discrete institutional innovations, this project aimed at understanding how the process of systemic innovation works best in relation to digital learning resources, and which factors, including governance and financing, influence its development.

Five countries participate in the project: Denmark, Finland, Iceland, Norway and Sweden.

The project only considers learning resources that are *digital* – either digitised or digital by origin. A digital resource is taken to be a resource that exists in binary numeric form, as in digital audio or digital pictures. “Digital learning resources” are any digital resource that is actually used by teachers and learners for the purpose of learning.

Each participating country put together a *background report* on developments in ICT and DLR over the last 10-15 years in compulsory schools. The Icelandic background report was delivered to the expert team in mid-August. Some additions and amendments were made to the draft and this version is the final version (December 2008).

Background reports are intended for five main audiences: CERI, the reviewers who will visit the country, those interested in DLR within the country that is writing the report, the countries participating in the review and those interested in DLR at an international level and in countries not participating in the review. After clearance by countries, background reports are placed on the CERI website and their availability will be widely disseminated.

Countries were expected to submit one short *case report* with short descriptions of two to three case studies as preparation for the experts’ visit. The national web portal for digital learning resources was to be one of the cases. The case report for Iceland was submitted to CERI in August 2008.

Experts visited the participating countries for three days. An expert team visited Iceland from 1st-3rd September 2008. The experts prepared a *country report* that was submitted to the Icelandic working group and key people from the case studies, for comments and corrections of facts, before publication. The country report highlights the cases, and reports on good practice as well as less successful examples, with particular emphasis on ICT-based innovation policies in the area of DLR. The Iceland country report is available on the OECD/CERI website.²

CERI is currently preparing a final *synthesis report* bringing together findings from background reports, case reports and country reports. It will be available in early 2009. CERI is also preparing benchmark indicators for use in a study on the status of ICT and DLR in OECD countries.

We thank the working group in Iceland, the CERI team and colleagues in other participating countries for discussions during the preparation of this report.

Allyson Macdonald and Sigurjón Mýrdal

Draft background report, 11th August 2008

Final background report, 20th December 2008

¹ http://www.oecd.org/document/47/0,3343,en_2649_35845581_38777391_1_1_1_1,00.html

² <http://www.oecd.org/dataoecd/10/7/41848715.pdf>

ABBREVIATIONS

DLR	Digital learning resources
ICT	Information and communication technology
IT	Information technology
ITE	Information and technology education (in the national curriculum)
IUE	Iceland University of Education (from 1998 until 2008)
MESC	Ministry of Education, Science and Culture
NCEM	National Centre for Educational Materials
Rannís	Icelandic Centre for Research
UCE	University College of Education (from 1971 until 1997)
UT	Upplýsingatækni (Information technology in Icelandic)

INTRODUCTION

1. Information and communication technology (ICT) entered the education system in Iceland in the 1980s and very quickly a variety of computers and educational resources became available, for example, software for use on IBM/PC, Apple and BBC computers. In 1988 a communication system using a Unix computer, called Imba 1, was developed by a school leader and the University of Iceland. Schools started connecting to the system in 1990 and by 1992 most compulsory schools in the country had joined the network (Ísmennt, n.d.).
2. Early digital learning resources (DLR) were written by computer programmers with an interest in education or in association with educators. In Iceland teachers and student teachers were introduced to mathematics programs and a physics educator started introducing students and teachers to programs for use on Apple computers, which were linked to sensors, recorded and reproduced data or modelled natural phenomena. The promise of ICT for areas such as language and mathematics learning, especially through drill and practice, seemed untold.
3. At the same time ICT was becoming common in the workplace and soon word processing, spreadsheet and database applications were making their way into schools. The 1989 national curriculum included a section on using computers in schools. With the rapid spread of the World Wide Web in the 1990s, both teachers and learners began to use or even design their own websites. The development of a myriad of possibilities for working with visual images opened the way for a mix of texts and images. DLR were beginning to take shape.
4. In Iceland such developments were occurring in a specific context: it is an island country, with a very high standard of living. It has a small but dispersed population, despite the sprawling urban southwest and a unique language and culture stretching back in time over 1100 years. Globalisation, technology and changes in Europe and the Nordic countries have influenced changes in society in Iceland.
5. This report will seek to understand the impact of the information society and the advent of ICT on schools and education and to explore the extent whether and how DLR have become part of the learning system.
6. The report is divided into five chapters (Figure 1):

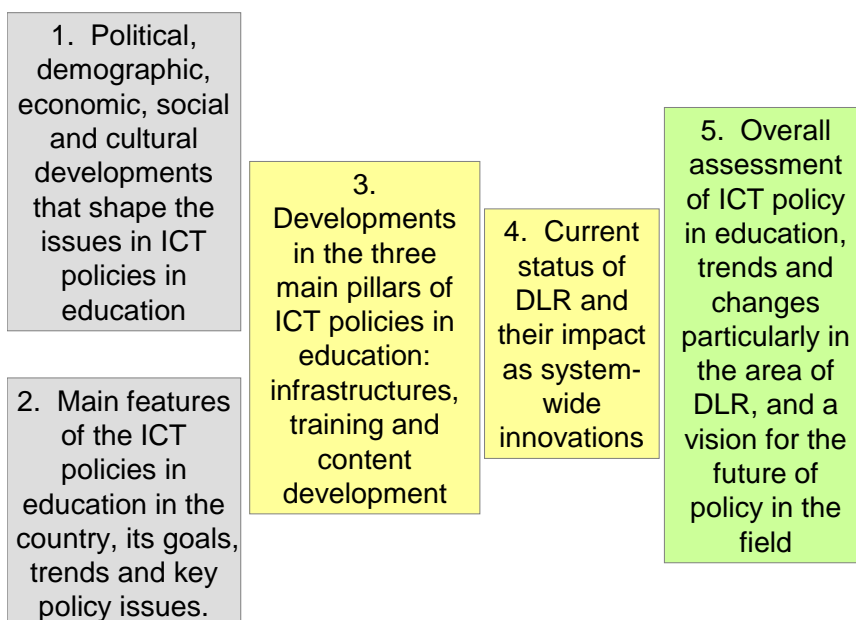


Figure 1 Report on digital learning resources (DLR) as systemic innovation

CHAPTER 1: CONTEXT

7. In the first part of this chapter the broad political, demographic, economic, social and cultural background in Iceland that shapes the issues that ICT policies in education must address are discussed. In the second part, national policy regarding ICT access and use, by government, firms and individuals, is discussed.

Iceland: high-tech life on a northerly island

Demographics

8. Iceland is a high-tech country with its citizens being quick to invest in any new information technology (IT). About 93% of the population lives in communities that are larger than 200 people, and about 63% live in the Greater Reykjavík area. In 2008 it is estimated that 92% of the population uses computers and 91% the internet, with slightly higher figures in urban areas. For those in compulsory schools the figures are respectively 84% in urban areas and 82% in rural areas but they rise to 100% in both cases for the 16-24 year age group (Statistics Iceland, 2008).³
9. The overall number of individuals using the internet in 2005-2006 is higher in Iceland (83%) than in the other Nordic countries, such as Sweden (77%), Norway (69%), Denmark (79%) and Finland (65%) and more people (16%) in Iceland consider themselves to have very good internet skills in 2005-2006 than in the other countries (13%, 10%, 14% and 8% respectively) (Statistics Iceland, 2008).
10. Nearly 80% of Icelanders used the internet for accessing newspapers and magazines in 2005, 20% or more than in the other Nordic countries. In Finland, Iceland and Denmark there are far more users of internet banking services (60-80%) than in Norway and Sweden (less than 25%). Internet use is also widespread in the business sector in Iceland, where 97% of companies have access to the internet, and 70% have their own websites (Statistics Iceland, 2008).
11. The situation was however reversed when the provision of public services (so-called e-Government) was considered in 2006. Here Sweden and Norway do the best (74%, 72%) then come Denmark and Finland (63%, 61%) with Iceland bringing up the rear (47%) (Statistics Iceland, 2008). Thus although individuals in Iceland are willing and able to use the internet, the provision of public services has not kept pace with these developments.
12. Iceland have a life-expectancy of almost 80 years. The country has a population of around 320.000 people, with somewhere between 4000 and 4200 being born every year for the last 20 years or so. About two-thirds of the population live in the urban south-west of the country.

The economy

13. Iceland was ranked with the highest Human Development Index (HDI) in the world in 2005.⁴ The HDI provides a measure of three dimensions of human development: living a long and healthy life (measured by life expectancy, Iceland 81.5 years), being educated (e.g. gross enrolment at the primary, secondary and tertiary level, Iceland 95.4%) and having a decent standard of living (e.g. GDP per capita, 36,510 USD).
14. Rural development has been an issue for many years in Iceland. The introduction of the ITQ (individual transferable quota) system for the management of fisheries in the 1980s had an effect on smaller communities. The introduction of distance learning options in teacher education and upper secondary education in the 1990s was in part a response to changes in rural areas. The Rural Development Fund, individual local authorities and the government have seen the development and use of ICT in education and in business as an important factor in maintaining services in rural areas. Other high-technology developments in fisheries, biotechnology and banking have all supported the development of ICT in Iceland.

³ <http://www.statice.is/Statistics/Tourism,-transport-and-informati/Information-technology>

⁴ http://hdrstats.undp.org/countries/country_fact_sheets/cty_fs_ISL.html

15. With changes in the law in 2003, policy-making in research, innovation and development was moved to cabinet minister level with the establishment of the Science and Technology Policy Council. In its policy document for the period 2006-2009 the Council said that it favoured “continued efforts to make the best use of ICT in order to keep Iceland among the leading nations in the use of ICT”. It also called for stronger collaboration between the public and the private sector, and for technologies capable of transferring large amounts of data for science, business or services.
16. With changes in the labour market and EFTA agreements, the number of foreigners living and working in Iceland has increased in recent years. In early 2008 there were nearly 21,500 foreign citizens in Iceland, representing about 6,8% of the total population (Statistics Iceland, 2008), up from 3,5% in 2003 and 2,1% in 1998. In 2005 there were about 9000 workers of foreign nationality in Iceland. This number rose steadily in 2006 and 2007 but started to drop again in late 2008. At the end of November 2008 there were between 12000 and 13000 foreign workers in Iceland but this number was expected to drop by January 2009, according to figures from the Directorate of Labour.⁵
17. Language and migration issues are becoming a reality in Iceland with many immigrants from Eastern Europe and South East Asia. Civil society organisations and educational institutions maintain services for individuals and families who come to the country. Learning Icelandic as a second or foreign language is receiving increasing attention, though opinions are divided on whether enough is being done. Of about 44 000 children in the compulsory school system there are over 1700 who did not have Icelandic as a mother tongue in 2008, compared with just under 1400 in 2004, just under 1200 in 2001 and about 750 in 1998. Language learning will be the focus of one of the two collective case studies.

Island culture with a long history

18. It is generally maintained that Icelanders have developed and still keep strong family ties. Their long history as an agricultural society until the Second World War meant that family members were dependent on one another. With increasing mobility in the late 1900s families have been quick to use new technologies. Generations keep in touch with e-mail and through technologies such as Skype, web cameras and blogs. Senior citizens attend computer courses and even the smallest children are familiar with DVD and mobile phone technologies. Large databases such as those for real estate and banking have become a common part of daily business in Iceland.
19. The culture of Iceland has also depended very much on the written word from the earliest times, with manuscripts dating back to the latter part of the 12th century. It seems that when ICT was developing in Iceland that the attachment to text was something of a constraint in that considerable effort was expended on text and less perhaps on visual images. ICT is now being promoted as a means of preserving cultural artefacts from previous times and providing new opportunities for research with copies rather than original documents.
20. It is worth remembering that the Icelanders have a unique language and cultural history which may limit the application of foreign DLR. The society is small with a small education market thus the production of specifically Icelandic DLR is relatively expensive. The role which the State Broadcasting Service could play in providing DLR is worth consideration (to be discussed in paragraph 116).

National policy on the information society 1995 to 2003

21. Computers were first introduced into Iceland in 1964. Over the next two decades (Oddur Benediktsson *et al.*, 2005) a variety of applications were developed, including the National Register of Persons, real estate assessment, financial systems, centralised processing of bank checks, fish stock abundance computations, IT in fish processing plants, the control of hydroelectric power stations, and the challenge of adopting the Icelandic alphabet to the use of computers. By the mid-1980s computer courses were being offered in schools, universities and

⁵ http://www.vinnumalastofnun.is/files/Nóvember%2008%20lokaskjal_2067451338.pdf

adult education evening classes. The internet as a concept was little known outside university and research circles, though the Imba network was to be established in 1990.⁶

22. From 1988 until 2001 a four person advisory committee (the so-called RUT committee), two civil servants and two from the private sector, met regularly and provided advice to the Ministry of Finance and the Office of the Prime Minister. In its early days issues which the committee addressed included local networks of personal computers (i. *einmenningstölvur*), viruses and the illegal copying of software (RUT nefnd, 1989, 1993). In 1993 it was pointed out that staff should have the requisite training for using complex software. The beginnings of policy on the deployment of information technology can be found in the work of the RUT committee which continued to function until 2001.

Vision of the Information Society 1996

23. Early in 1996 a draft of a policy on Iceland and the Information Society appeared, with an introduction written by Minister of Finance in December 1995. The draft was based on the work of the RUT-committee.

24. Later in 1996 the Office of the Prime Minister prepared and published the policy document *Vision of the Information Society*. In the foreword written by the Prime Minister two kinds of qualities of Icelanders were emphasised: their driving spirit and openness to innovation (later discussed both as a vice and a virtue) and their belief in their own cultural uniqueness which itself is largely built on a long history of information (Prime Minister's Office, 1996). The Prime Minister suggested that ICT must be used for the good of the nation, both for individuals and society. The Minister of Industry and Commerce said that there was a need to mobilise and harness the use of information to improve the standard of living and culture in Iceland. Access to information should be ensured, bureaucracy reduced, and the best possible welfare system maintained. The country should use ICT to create new opportunities.

25. Nine work groups were appointed and their portfolios indicate the broad view of the information society that was emerging in Iceland (Prime Minister's Office, 1996, p. 3). The groups were:

- Democracy, law and ethics
- Wage earners and consumers
- Economic and commercial sector
- Governmental administration
- Telecommunications and multimedia
- Education, science and culture
- Health services
- Social services
- Communications and travel services.

26. In the *Vision of the Information Society* the Minister of Industry and Commerce stated that:

Iceland's uniqueness is that we will utilise information and telecommunications technology proportionally better than larger nations since open access to information and free transactions over the information highway increase the competitiveness of smaller companies with respect to larger ones

27. The Minister referred specifically to the value of a relationship between IT and education saying that it could be used to give people on the labour market opportunities to gather new knowledge: "The mission of education in the new type of society will therefore never be overestimated." He added: "We must therefore increasingly emphasise general, fundamental knowledge and continuous education since education is the basis of the knowledge upon which this progress is based."
28. Although it was emphasised that there was a need to be aware of some of the dangers of the information society, its benefits were that IT could be used to strengthen democracy, increase social equality and strengthen the unique culture and language.

⁶ <http://ismennt.is/main.asp?id=1&uid=1>

29. It was stated that individuals and companies will have a role to play, not just government. There were divergent views on whether government can actually influence the development of ICT. Despite this observation, this first major policy document still considers the government to be a key player in developing the information society. Guidance (by government) and vigilance (of government) were needed to achieve the vision of being in the forefront, of using IT to improve living conditions and prosperity. It was suggested that ICT could be used to reduce the disadvantages of Iceland's sparsely settled areas and geographical isolation, both within the country and as an island.

Objectives and actions in the Vision

30. The policy put forward in the *Vision* had five main objectives:
- Access to ICT should be easy.
 - Equality between public and private sectors had to be ensured.
 - ICT should be used to increase competitiveness.
 - Education should adapt to changed social dynamics – look at the advantages of the information society but guard the unique language and culture.
 - Legislation and methods were to be re-examined to stimulate progress and protect individuals and companies.
31. The following actions were mentioned as being important to the implementation of the policy:
- Citizen and society:* Access guaranteed without respect to economic circumstances or residence, possibilities assured to citizens for life-long education and training for new jobs as needed, improvement of national and local government services, protection of rights of the disabled and the unemployed, development of library services, retraining for a competitive economy, legal issues and ethics to be addressed, hindrances eliminated and pass new laws where necessary e.g. copyright, confidentiality, security.
- Education:* New views of education must be considered e.g. the “grammar of graphics”, IT used to benefit the life and work of all Icelanders through education, IT to be emphasised in the curriculum, schools to be provided with equipment, especially for disabled, “The operations of the Educational Network⁷ must be robust”, continuing education, self-instruction, data banks and use of IT in school subjects to be encouraged, courses and support for practising teachers, specialist courses in IT to be provided at secondary and university levels.
- Research and development:* R&D in IT was to be encouraged as was the use of IT in R&D.
- Health:* Creation of a data bank on health matters, computerisation of the health system.
- Telecommunications:* Conditions to be created for increased competition in telecommunication services, mass media should participate in international competition, the mission of the State Broadcasting Service re-evaluated and Icelandic programming encouraged.
- Culture and travel:* IT to be used in travel and transport, the creation of digital maps, the language and culture to be strengthened, information banks for travel services and tourists constructed and for environmental affairs.

Implementation of the Vision

32. Implementation of the policy was considered important. A project team was created and based in the Prime Minister's Office and its brief was to coordinate and monitor developments, with the budget as a tool. Members of the team were from the Ministries of Finance, Education, Transport, and Industry and Business.
33. The policy encouraged consultation between the public and private sector. There was to be more direct access by the public to government initiatives, funds to development would be increased;

⁷ The Educational Network; see also paragraph 68. <http://ismennt.is/main.asp?id=1&uid=1>

- and priority projects included the computer literacy of the nation, with an emphasis on the mother tongue and foreign languages, data transport services and a policy of tender offers.
34. The implementation of the vision was assessed through status reports from all the ministries in 1998. Key committees in 1998 concerned access to databases, a new library system, the establishment of a teaching centre, the filing and conservation of digital material, difficulties expected with the year 2000, legal material and the development of software. Four of these committees were working within MESC. Funding of about 1,3 billion kr. in all, including contributions from individual ministries went into the project including 133 project grants, of which one-fourth went into education. In all seven projects concerned teacher education, nine school-learners, three training for the general public, one for the private sector and two for the education of civil servants.
 35. The vision was not formally evaluated as such, but some results of its implementation were published in 2003 in *Iceland and the Information Society 2003* and in a related study by IBM (2002). The IBM report stated that the initiative taken by the government had been successful and that most of the original goals had been met.
 36. One of the suggestions made in the IBM report was to define and develop a simple portal for the general public according to the needs of the public and not according to the organisational charts of the ministries. Such a portal has been established <http://www.island.is/>
 37. The IBM team also noted that IT had become an integral part of policy and practice in all ministries and that the need for a centralised scheme should be assessed. Analytical approaches such as PEST and SWOT were used in the report. Several of the political and social factors affecting IT were related to education. Research on ICT, digital learning, democracy and access to information, technology for serving rural areas, library systems, maps and databases were all mentioned, as well as work opportunities, teaching technologies and the union of computers, telecommunications and the traditional media.
 38. The report stated that the government had supported education projects reasonably well in improved information literacy and access to information, though there were still gaps in skills, especially between generations and according to income and education.
 39. In the conclusion of the report (IBM, 2002), four areas for future emphasis were identified: public services, a profitable private sector, effective governance and modern education and applied research. Instead of a dedicated project team it was suggested that an action plan covering the next 2-3 years to be implemented by individual ministries could be more effective. Ministers should monitor actions taken, some tasks could be outsourced and more international cooperation should be encouraged.
 40. Iceland may be unique among Western nations in that its library and information specialists negotiated for country-wide access to academic resources, ensuring a high level of service for academic life.

Targetted research on and with IT

41. From 1999-2004 (six years) the government supported two areas, information technology and the environment, through a targetted research programme which was administered by the Research Council of Iceland (Rannís, 2001). The criteria used for granting funds to projects were of a broader nature than those used in making grants through the Science Fund. There was an emphasis on cooperation between those who carry out research and those with specialised knowledge in the field and on projects which might have a positive interaction. Several projects in education, the humanities and social science received grants, including some which were initiated by university researchers. Indeed one of the objectives of the programme was to provide opportunities for general and continuing education to adapt to the new technologies.

National policy and initiatives since 2003

Resources to serve everyone 2004

42. The evaluation of the 1996 policy led to a new policy document, *Resources to Serve Everyone: Policy of the Government of Iceland on the Information society 2004-2007* (Prime Minister's Office, 2004) which was preceded by a discussion document (Prime Minister's Office, 2003). It seemed that progress had been made in some of the areas suggested in 1996. It was claimed in the policy that "In many Icelandic schools, information technology has become an ordinary part of school activities..." Some areas had been difficult to implement, for example, high-speed connections in some areas were not always available or were limited and in some parts of society technology was not being used as much as needed.
43. The *Resources* document argued that there was a need to keep improving Icelandic society – the participation of all fields of work, private organisations, directors of government institutions was needed. Individuals, opportunities and welfare were still the guiding principles of the policy: everyone should have an opportunity to benefit from resources in information, knowledge and innovation and the quality of life should be improved.
44. Four main pillars were to be part of further development. These were
 - Seizing opportunities*: in democracy and government administration, and in e-business and the employment sector.
 - Ushering in change in a responsible manner*: working towards access for everyone and realising that change was everyone's responsibility.
 - Ensuring security*: of the individual and of business, through better use of telecommunications, development of electronic signatures, working towards standardisation and consultation and emphasising ethics and security
 - Enhancing the quality of life*: through the benefits of IT in education and science, culture, environmental issues, health care and social services.
45. The Prime Minister's Office, through the Information Society project, has established an information service for the general public <http://www.island.is/>. The site includes information on employment opportunities, housing matters, consumer issues, family concerns, finance, senior citizens, health, travel, education, the disabled, immigrants and local affairs. Parts of the website have been translated into Polish, Croatian and English.

Telecom Policy Statement 2005-2010

46. In 2005 a policy statement on telecommunications was prepared by a group appointed by the Minister of Transport and Communications (2005). The main statement (p. 8) says: "Iceland should be ranked among nations enjoying the most efficient, secure, accessible and innovative electronic communications services." The privatisation of electronic communication only a few years ago has encouraged the government to spell out its policy. Measures open to the state in a market-economy include imposing obligations on electronic communications enterprises, taking the initiative in technology and services, financing projects for the public good, security purposes, environmental reasons or regional development and tendering services for public parties. A note of caution about the division of responsibility is however introduced: "State involvement in providing electronic communications should be limited to those areas where market actors are not prepared to offer acceptable services and prices"
47. The policy introduces the idea of *extended universal service* which includes high speed connections for transmission of voice, images or data, accessible GSM mobile phone services and television transmission to remote areas by digital satellite transmission. It is stated (p. 10) that Icelanders are legally entitled to receive universal service but that extended universal service will depend on various factors, including the national budget.
48. The convergence of voice, sound and image systems into data network that can transmit all types of services is becoming a reality and users can demand *ubiquitous networks* (p. 16). High-speed connections should be available to all schools in the country (p. 23), households and

enterprises (p. 25) and “The future vision is to have the Icelandic school system at the leading edge” (p. 23).

49. The telecom policy statement includes a section on digital television and radio. An increasing number of households in Iceland use ASDL equipment for wireless household internet. More Icelandic broadcasting content should be accessible, according to the policy, and older material can be converted into digital format. Copyright issues however will need to be addressed.

Iceland the e-Nation 2008

50. During the winter of 2007-2008 a committee appointed by the Prime Minister was charged with formulating a new policy on the Information Society. Permanent secretaries of all twelve ministries sat in the core group and over 40 other individuals formed part of the consultation group. The new policy *Iceland the e-nation* was launched at a conference on 7th May 2008 (Prime Minister’s Office, 2008).
51. The new policy is based on the vision of Iceland being (becoming) the leading nation in electronic services and the use of IT, based on the slogan or guiding principle “User-friendly, efficient service – no need to wait your turn”. The policy builds on three pillars: *service*, *efficiency* and *progress*. The service pillar builds on the notion of self-service for e-citizens, where online requests and information services are readily available. Efficiency builds on the idea that data and not people should travel from one public body to another.
52. Competitiveness is linked to progress in the policy, building on innovation, research and education, which in turn must be supported through IT applications with links to decision-making in public bodies and to the commercial sector. Measures to be taken in education include:
- Increasing the use of IT, for example by supporting IT leaders in schools,
 - personalised online examinationa with an examination database, and
 - digital educational materials for compulsory and upper secondary schools.
53. In addition two particular educational activities were identified by the Ministry of the Environment in this regard, the development of study materials on soil conservation and a distance learning package for examinations in hunting and firearms. No other ministries identified educational measures.

Summary and implications

54. Iceland entered the information society and brought in and developed ICT with enthusiasm. It is a highly technological society with an active private sector. Over 400 enterprises were operating in the IT sector in 2005, employing over 6000 individuals. In the mid-1990s the Office of the Prime Minister published its first policy document on the Information Society. A special office for the Information Society was established in the Prime Minister’s Office in 1996. A targetted research programme on IT was funded from 1999-2004/5.
55. Both the public and the private sector have been and still are willing players in the information age. As we will see in the next chapters there was government coordination on the issue of IT and the information society (see Table 2.1). In the mid-1990s the Ministry of Education, Science and Culture published the first of its policy documents on the information society and a IT development division was established in the Ministry of Education in 1999/2000. A new national curriculum for preschools, compulsory and secondary schools was issued by the Ministry in 1999, in which using IT was to be seen as a cross-curricular opportunity as well as a skill in itself.

CHAPTER 2: ICT POLICIES IN EDUCATION IN ICELAND

56. The purpose of this chapter is to outline the main features of the ICT policies in education in Iceland, its goals, trends and key policy issues. An overview of key policy decisions and actions is to be found in Table 2.1.

Computers in Icelandic education in the 1980s and early 1990s ⁸

57. In the 1980s two advisory committees were established by the Minister of Education on computers in schools, both under the leadership of university professors, one established in 1982 and the other in 1986 (Ministry of Science, Education and Culture, 1987).
58. The 1982 committee made the following suggestions:
- A curriculum for computer studies for “general teaching”, for vocational studies and for teacher education should be written.
 - A subject advisor (based in the ministry) should be appointed.
 - A research centre for the “new information technology” should be established.
 - Teacher education should be strengthened (a lot)
 - Computers should be bought both for compulsory schools and secondary schools.
- (Ministry of Science, Education and Culture, 1987).
59. A different set of priorities were proposed by the 1986 committee (Ministry of Education, Science and Culture, 1987), which included less emphasis on computer studies and more on computers as a teaching aid. To this end the development of software was encouraged and students were to learn skills that would serve them when going on to work. A separate centre for research was not recommended; instead existing institutions within or outside the school system should encourage development where appropriate. It was agreed that teacher education should be strengthened, cost efficient purchases should be encouraged when buying computers for schools and that advisory services should be supplied.
60. An agreement was signed between the ministry and the Institute for Computer Services at the University of Iceland (Ministry of Education, Science and Culture, 1988) in terms of which the institute would collect national and foreign software and evaluate its educational value, would make contracts with programmers on the translation and distribution of materials, would try out new technology related to schools, would support teachers with writing programmes and would develop a bank of algorithms which could be used by programmers working with different systems.
61. A computer advisor was appointed in 1986 and she took part in Nordic cooperative projects, such as *Data programgruppen og Nytt um data i skolan* (personal communication, Kristín Jónsdóttir). The former project provided Iceland with access to software being developed in other countries. At first the Institute for Computer Services was involved, as described above, but the task was moved to the NCEM which translated and published 74 programmes during the period 1989-2000. The second computer advisor prepared two newsletters for distribution to schools, in April and November 1989 (Ministry of Education, Science and Culture, 1989a, 1989e), summarised the resources then available (1989b, 1989c, 1989f) and considered the general status of computers in schools (1990a) and in teacher education (1990b)
62. As early as 1984 and 1985 the Ministry had recommended that IBM computers be purchased in compulsory schools and Apple computers in secondary schools (Ministry of Education, Science and Culture, 1989d). Surveys on computers in compulsory and in secondary schools were carried out by the Ministry in the late 1980s (Ministry of Education, Science and Culture, 1989d, 1990c). In compulsory schools in 1988 there were only slightly more IBM computers (42,5%) than BBC (38%) and a lot of software was available for BBC computers in English. Apple computers made up almost one-fifth. About 44% of the schools had no computers for

⁸ All but one of the references above are in Icelandic and most of them have not been published. They have been assembled from ministry archives by Kristín Jónsdóttir. The non-Icelandic reference is in Danish.

students though on average there were three computers per school and about 80 students per computer. Over half the schools had no computers for teacher use.

63. In secondary schools by 1989 80% of computers were IBM and only 12% were Apple, despite earlier recommendations. A significant decision was made by the Ministry in 1993 (Ministry of Education, Science and Culture, 1993). The software which was being made available through Nordic cooperation was all IBM compatible. It was decided, for economic reasons, that henceforth funds would only be allocated to IBM compatible computers. A letter was sent to all schools in November 1993 to this effect where the economic viewpoint was laid out for schools.
64. In summary, computers entered schools in Iceland in the 1980s and the Ministry established two committees to review priorities in 1982 and 1986. Slightly different priorities put forward by the later committee including the idea that it would be useful to emphasise the role of the computer in teaching and learning rather than studying the computer itself. The beginnings of ICT as a learning and a management tool are to be found here. The Nordic cooperation of the late 1980s and well into the 1990s provided a source of software (DLR) which could be translated for use in Icelandic schools.
65. It is not possible to identify in this review the reasons for the Icelandic decision (also made in many other countries) to advise schools to buy IBM compatible computers and to fund (almost exclusively) the translation and development of materials suitable for use on IBM type computers. Some of the early innovators in schools were great believers in BBC computers and the educational software (in English) available for use in schools.
66. Perhaps it was a combination of the wish to preserve and strengthen the use of Icelandic, coupled with Nordic cooperation which was a cost-efficient option for Iceland, that pushed development towards IBM compatible software, which then became the foundation for options for working with the WWW and developing web-based materials.

Connecting schools, connecting teachers – the early days

67. Computers had entered schools in Iceland in the 1980s, as indicated above. Several brands of computer were in use, including the early Apple computers, BBC and Archimedes computers from Britain and IBM personal computers. For example, the possibilities for using Apple computers in practical physics or BBC computers in mathematics lessons were taught in in-service courses at the Iceland University of Education, networks of programmers sprang up, the qualities of different brands were argued and word processing became more and more common.
68. In 1988 a school principal in the rural north-east invested in a Unix computer, which came to be known as IMBA, with the dream that schools would communicate with each other (Ísmennt, n.d.). Schools began connecting in early 1990 and by 1992 it was clear that networking between compulsory schools had become a fact. Several organisations had supported the establishment of the network which provided services to teachers, learners and school leaders. Those working for the network were both teachers and programmers thus providing relevant support for schools.
69. The municipality of Kopasker, MESK, the University College of Education (UCE), the parliament, the Teachers' Union, the educational office in the north-eastern district and others took part in the establishment of the internet company Íslenska menntanetið hf. which was generally known as *Ísmennt* (Ismennt, n.d.). Three year plans were put in place in schools – first technology, then the attainment of skills by teachers, finally the use of computers in the classroom. Schools around the country were visited. Many courses were being held using the net. Schools paid according to size and not use. The *Ísmennt* web had information and guidelines for teachers on the use of ICT with links to other websites related to education. All teachers received an e-mail address without cost to them but schools became the subscribers to *Ísmennt*.
70. In the early 1990s there was increasing political pressure to improve the qualification of teachers in rural areas and the University College of Education realised that the network could be used in the development of a distance learning program. The College's participation in

Ísmennt was linked with the launching of a four year B.Ed. teacher education program in January 1993 (Jóhannsdóttir and Skjelmo, 2002).

71. In July 1996 the Ministry of Education, Science and Culture bought that part of the company Ísmennt which served schools and cultural organisations and outsourced the running of the company to the University College of Education. This was done at about the same time that the key policy document to be discussed in the next section was published. In December 1999 the minister decided to sell the Ísmennt company, which was bought by Skýrr hf.

Policy-making in the mid-1990s

Legal and other changes in education

72. The late 1990s were a time of major changes in education in Iceland. There were several major legal changes in schools in the 1990s, with new laws on preschools in 1994,⁹ on compulsory schools in 1995¹⁰ and of secondary schools in 1996.¹¹ New administrative arrangements had to be made at the same time that changes in technology and opportunities offered were becoming even more diverse and at the same time demanding. Resources were needed, both human and financial, and operational mechanisms had to be put in place. Graduate programs at the Iceland University of Education were being developed, leading to new ideas and change in some areas.
73. In 1996 the transfer of compulsory schools from national government to local authorities began in accordance with a policy document from 1994 and the new law from 1995.¹² Some local authorities were supporting initiatives to encourage the use of information technology, schools were upgrading their computer facilities, school districts were using the number of children per computer as an indicator of investment, and facilities were being upgraded within schools. Teachers were being sent on courses to upgrade their IT skills. The distance learning teacher education program was attracting increasing numbers of students all of whom developed a level of IT expertise during their studies.
74. In the mid- to late 1990s a large secondary college in Akureyri became the first secondary school to offer distance courses and other secondary schools soon followed suit. In 1995 four grants were made for the development of materials to be used in such an approach and over the next few years extra or targeted funds would be put into training and the development of materials, both by the Ministry of Education and by local authorities.
75. The new laws on education in the mid-1990s were followed by a major revision of the curriculum for all school levels and in all subjects in 1999.¹³

The power of information 1996

76. A key policy document on education, culture and information technology, produced by a specialist committee appointed by the Minister of Education, was released in 1996 (Ministry of Education, Science and Culture, 1996). It was called *The power of information: Proposals from the Ministry of Education, Science and Culture about education, culture and information technology 1996-1999*.
77. The policy document begins by proposing that the information technology is the way forward, even though it may have some drawbacks. The need for a policy in the area and a clearer role

⁹ <http://eng.menntamalaraduneyti.is/Acts/nr/2439>

¹⁰ <http://eng.menntamalaraduneyti.is/Acts/nr/2432>

¹¹ <http://eng.menntamalaraduneyti.is/Acts/nr/2435>

¹² The school system is small with about 45.000 children aged 6 to 15 enrolled in about 180 compulsory schools, of which about half have fewer than 100 pupils and only a handful have over 600 pupils. There are over 3000 teachers in the compulsory system, with average age a little under 40. Nearly 20% do not have teaching qualifications though some are well-qualified in other areas (Statistics Iceland).

¹³ In spring 2008 new laws were passed on preschool education, compulsory schools, secondary schools and teacher education.

for the ministry in its implementation is proposed, though it is acknowledged that most achievements in society, education and culture have been built on individual efforts and not those of the state.

78. Thirty aims for the next three years (i.e. the years of the curriculum revision) were listed in three areas – the educational system, cultural life and the services to be provided by the Ministry. Each of these three areas then received detailed attention with regard to imminent or possible change and objectives being set.
79. It is in this seminal policy document that the potential of digital learning resources and new opportunities for learning are suggested, even explored, more so than in any other policy document that was to follow. The longest section is on learning resources and falls under the heading ‘software’. Objectives are set with regard to the production of a range of Icelandic materials for teaching and learning and for communication.
80. In Chapter III.2 of the policy document it was stated that one means of many of achieving the objectives would be to strengthen the capacity of the National Centre for Educational Materials (NCEM) to produce software.¹⁴ In Chapter III.3 teacher education, both pre-service and in-service is discussed and the use of ICT in all subject areas in teacher education is to be encouraged, as well as in continuing education. Support to teachers should be available, both on-site and through the internet, and school leaders should have the opportunity to keep up with developments in ICT.
81. Other examples mentioned in the document include:

p. 15 Learning materials will change. Access to custom-designed programs, teaching programs, multi-media materials and the internet will to some extent replace printed information. The use of material, produced outside the school system, will increase. There will be an emphasis on students being able to read, interpret and use the materials that the media and others distribute, and to create knowledge.

p.23 Original, translated or adapted software will be carefully tested under different conditions in schools, before it is distributed for general use.

p. 23 ‘Nuclear schools’ will be created which will work closely with NCEM and the teacher education institutions. These schools will have the following role in the development of teaching software for schools:

Advice on the design of software
 experimental teaching with the software
 advice to NCEM on the assessment, choice and procurement of software
 advice to users in specific areas
 methodological support for teachers
 teaching on courses run by teacher education institutions
 make accessible reports of experimental work.

p. 27 All classrooms, workrooms and offices will be connected to a local area network which itself is connected to the internet.

p. 28 School timetables, the placement of hardware, their number and type will be such that it will be possible to use ICT in all school subjects.

p. 29 It is important to support and strengthen research on the use of ICT at all school levels and research on the effect of ICT on education, culture and morality.

¹⁴ <http://www.menntamalaraduneyti.is/utgefid-efni/utgefin-rit-og-skyrslur/HTMLrit/nr/2028>. “Námshagnastofnun þarf að gegna lykilhlutverki í öflun hugbúnaðar fyrir grunn- og framhaldsskóla,”

National agencies for ICT in education

Ministry of Education, Science and Culture

82. The Ministry of Education, Science and Culture (MESC) is a key national agency for ICT in education. Since the mid-1990s it has formulated key policy documents, as discussed below. For several years there was a development division within MESC dedicated to the use of IT in school development. This division oversaw the ‘nuclear school’ project in three compulsory schools and three secondary schools from 1999-2002/3, a project that was initiated in the wake of the policy from 1996 *The power of information*. In a restructuring of the ministry in 2005 the members of the division relocated in other divisions. Ministry officials developed the notion of the national portal known as the Education Gateway (see Case A.1), building in part on the idea of ‘distributed education’ which was part of official policy in the document *Advantage for the Future* in 2001.

National Centre for Educational Materials

83. The National Centre for Educational Materials (NCEM) (see also Chapters 3 and 4 and Case A.2) has the official task of producing high quality materials for use in compulsory schools. The total budget for the NCEM is decided by the MESC but the NCEM director makes in-house decisions about funding for digital activities (see paragraphs 149 to 153).

Development funds

84. A tool available to the MESC for nurturing grassroot development has been a development fund for compulsory schools. There are also funds for pre-schools and upper secondary schools and occasionally grants or projects have crossed borders between schools. The funds are open for applications once a year. An advisory committee with representatives from the ministry, school leaders, teachers and teacher education prepares a proposal for submission to the minister on areas of emphasis (target areas) and later on projects suitable for funding.
85. For the last decade target areas are often advertised two years in a row. Besides these priority target areas, there is also an open category, within which applications have not always been successful. Some funds were used to encourage projects using IT in an innovative way in 1997, 1998 and 1999. An analysis of projects receiving funding indicates that almost every year since 1995 there have been projects involving the use of ICT in schools.

Funds for inservice training

86. A tool used by the MESC to support development and change has been a fund for inservice training of teachers in compulsory schools which was established in the late 1990s after school management had been moved to local authorities. District education officers, teacher educators, schools or groups of schools and other individuals or groups can apply for funding to hold courses. Applications for IT courses were often successful and in the five year period 2003-2007 15 courses related to IT were funded out of a total of over 400 courses for compulsory school teachers.
87. Block funding, for specific IT inservice training, was granted by MESC to the IUE inservice department in the late 1990s for courses to be held around the country in the wake of the new 1999 curriculum. The experience of running this series of courses raised doubts among the course developers about the efficacy of such an approach since it was found that teacher skills varied from beginner to expert and such courses did not cater for a range in skills (Lemke, 2005, also see discussion on Garðabær, paragraph 170). The annual IT conference (see paragraphs 160, 161, 177) was also viewed as an inservice opportunity by MESC.
88. Many municipalities have supported inservice IT training for teachers.

Table 2.1 Overview of national policy on the Information Society and educational policy on ICT

	Office of the Prime Minister	Ministry of Education, Science and Culture (MESC)	Actions taken
1996	<i>Vision of the Information Society</i> 17 pages	<i>The power of information: Proposals from the MESC about education, culture and information technology 1996-1999.</i> 77 pages.	Revision of national curriculum. begins. Funds for school development projects
1997			Revision of national curriculum in progress. Targetted funds for school development projects.
1998	Status report 1998 Chapter 3.10 MESC On the implementation of government policy on the Information society.	(Status report)	Revision of national curriculum in progress. Targetted funds for school development projects. Establishment of research programme on research and development in IT and environmental matters for the period 1999-2004 (16.02.98).
1999		<i>National curriculum for compulsory schools. National curriculum for Information and Technology Education.</i>	Revision of national curriculum completed. Funds for inservice education of teachers. Funds for school development projects. First annual IT conference. Establishment of three development. schools at compulsory and three at upper secondary level. Each school received financial support for four years.
2000			Funds for school development projects. Annual IT conference. Extra funds for learning materials.
2001		<i>Advantage for the Future: project plan of the Ministry of Education, Science and Culture for e-Learning.</i> 17 pages.	Funds for school development projects. Annual IT conference. Extra funds for learning materials.
2002	[IBM report]		Funds for school development projects. Evaluation report on the six IT schools. Conference on the six IT schools. Annual IT conference.
2003	<i>Iceland and the Information Society.</i> 14 pages.		Funds for school development projects. Annual IT conference.
2004	<i>Resources to serve everyone: Policy of the government of Iceland on the Information Society 2004-2007.</i> 24 pages. <i>Science and technology policy Iceland.</i> 16 pages.		Funds for school development projects. Annual IT conference.
2005		<i>Risk with responsibility. Policy for ICT in education, science and culture 2005-2008.</i> 45 pages.	Funds for school development projects. Annual IT conference.
2006	<i>Science and technology policy 2006-2009.</i>		Funds for school development projects. Annual IT conference.
2007	[Capacent report]		Funds for school development projects.
2008	<i>Iceland: the e-society.</i> 12 pages.		A small section on education in the new policy

The new compulsory school curriculum

Revising the curriculum 1999

89. A major revision of the national curriculum for pre-schools, compulsory schools and secondary schools was carried out from 1996 to 1999. A project manager was appointed in early 1996, coordinators for different subject areas were employed from mid-1996 and preparatory groups with members from a range of backgrounds were set up to prepare the appropriate overall goals for each subject. In several cases the chairmen of the preparatory groups were from universities, academic specialists in their area of expertise.
90. Workgroups for each subject were appointed from mid-1998 to prepare sets of final goals for all subjects, and measurable aims for the 4th, 7th and 10th grades and for secondary schools. The coordinators chaired the workgroups. Objectives for most subjects were also written for each grade. The final curriculum documents were published in the spring of 1999. The preparatory and the work groups worked simultaneously on the curriculum for both compulsory and secondary schools in an attempt to ensure some continuity and progression.
91. All other curriculum workgroups had been advised by the project management to include the use of ICT in the aims and objectives of individual subjects wherever possible. There was one new curriculum area, on life-skills. The curriculum for compulsory schools underwent further revision in the mid-2000s. In many cases the changes were not substantial. Schools have until 2010 to adapt the school curriculum to the new national curriculum. The subjects in the national curriculum and their time allocation are shown in Appendix I.

Purposes, goals and objectives of ITE 1999

92. In August 1997 a preparatory group presented a proposal for a new curriculum area in information technology under the title *Goals for information and technology education in compulsory and secondary schools* (MESC 1997). New to the curriculum were goals for the areas of *Library studies* (later renamed *Information studies*) and *Innovation and application of knowledge*. *Carpentry* was also to become one section of the new ITE curriculum area, being moved away from the other creative arts and practical subjects, and was renamed *Design and construction* (similar to CDT i.e. craft, design and technology in some English-speaking countries).
93. The preparatory proposal was developed further by a working group and submitted as the *National curriculum for Information and technology education* in 1999 (hereafter called ITE-1999) (Ministry of Education, Science and Culture, 1999). The new curriculum in IT had three main chapters and a sub-section on computer use. The three chapters introduced three new curricula – information studies; innovation and application of knowledge; and design and construction. Detailed objectives were provided for the use of computers up to the 10th grade and for information studies up to the 4th grade (Table 2.2).
94. It is stated clearly in the ITE-1999 curriculum that the sections should be treated as cross-curricular areas and integrated into other courses. IT was to be a tool and not a subject in itself.
95. A revised version of ITE-1999 was published in 2007, the main changes being that the section on information studies was placed first and the sections on design and carpentry were removed to a separate curriculum/booklet. The guidelines for ITE-1999 can be used until 2010. The areas of the compulsory curriculum in information and technology education in 1999 and 2007 are shown in Table 2.2.

Table 2.2 The information and technology education curriculum in 1999 and 2007

	Chapters in 1999	Chapters in 2007
<i>Computer use</i>	Attitudes Computer literacy Using computers Understanding computers (Note: Not one of the three main areas but a cross-curriculum skill)	Chapter 2
<i>Information studies</i>	Technology literacy Information literacy Cultural literacy	Chapter 1
<i>Innovation and the application of knowledge</i>	Information and technology literacy Idea, solution, artefact Individual, technology and the environment	Chapter 3
<i>Design and construction</i>	Industrial design and innovation Technology fundamentals Handwork and the workshop Production Individual, environment and the culture of work Influence on attitude and skills of learners in daily life Supporting factors	<i>Design and construction (2007)</i> <u>In an independent guide</u> Handwork and the workshop Design and innovation Technology fundamentals Environment The work process Individual, work culture and protection Individualised learning

Managing change

Managing the revision 1996-99

96. The revision of the national curriculum was managed as a major project. Lines of communication in the project were short and direct. The minister at the time has asserted that it is one of the largest projects even undertaken by government (research interview, 2003, Macdonald, Hjartarson and Jóhannsdóttir, 2005). The minister indicated that his contribution to the curriculum revision was primarily to build a framework for the project. The professional content was to come from experts, including the ministry officials and teachers (Macdonald, Hjartarson and Jóhannsdóttir, 2005). Senior department heads of MESC formed a management committee with the project manager, who had been appointed from outside the ministry. This committee made final decisions on educational rather than administrative matters.
97. The revision of the Information and Technology Education (ITE) curriculum came under scrutiny in a research project (Macdonald, Jóhannsdóttir and Hjartarson, 2005). The researchers felt that the IT section of the new curriculum made new and challenging demands on schools and teachers and sought to understand the perspectives of the key individuals in the development of the ITE curriculum.
98. In interviews taken in 2003, the manager of the curriculum revision as a whole and who had a particular interest in the ITE curriculum, attributed his appointment to the fact that he could bring a fresh perspective to education; the subject coordinator for IT during the curriculum revision said that he viewed the national curriculum as some kind of map of knowledge, with different ways of getting to the same destination, and that he felt that it was the role of educational authorities to map out some of the ways; and the chairman of the preparatory group, a professor of engineering, who worked closely with the ITE coordinator felt it had been important to introduce more technology and methodology into the curriculum (Macdonald, Jóhannsdóttir and Hjartarson, 2005).

Managing implementation – the development division

99. The revision of the ICT curriculum in Iceland was unlike other subjects in that ICT had received and would continue to receive considerable attention from policy-makers and the employment sector.

100. The minister established a development division, the members of which had frequent and easy access to him (see paragraph 82). Some of the experts in the division took an active part in Nordic and European cooperative projects and found this aspect of their work to be especially useful. One had a background in secondary school teaching and had worked for the company Ísmennt, another had a doctoral degree in politics and teaching experience and a third had been a compulsory school teacher. A fourth worked mainly on cultural projects.
101. One of the largest projects managed by the division was the ‘nuclear schools’ project which is discussed in more detail in Chapter 3 (Jónasson, Dofradóttir and Blöndal, 2002, see paragraphs 163 to 168).
102. Another activity to be discussed in Chapter 3 was the annual IT conference run by the development division (see paragraphs 160, 161, 177).

The role of international links

103. The Nordic SchoolNet ODIN was set up in 1994 by the Nordic Council of Ministers. Staff of the Ísmennt company had taken part in this network. One of the benefits of Nordic cooperation in digital learning resources was the earlier establishment of the DATA-group (gruppen) in which Iceland participated. Through this Iceland had access to and could translate Nordic material for use in Iceland; some of this material was translated and adapted by the National Centre for Educational Materials (NCEM).
104. In early Nordic cooperation Iceland was considered to be a pioneer with the establishment of the Ísmennt company and its website and its emphasis on connecting schools. Later Denmark took a leading role. There had been a drive in Denmark to build up infrastructure in schools, which meant that the Danish participants were more interested in CD than web-based material, intended for use on computers within a school and not dependent on network connections. The IDUN project under the auspices of the Nordic Council was developed at this time to support the use of ICT in schools.
105. In 1999 a project called IDUN II was initiated by the Nordic Council. There were three parts to the project, innovations in schools, IT in teacher education and adult education education. One of the Icelandic experts was designated as the editor for cooperation between schools (personal communication, Jóna Pálsdóttir). From 1996-2005 an advisory committee (IT-policy gruppen) provided advice on developments and trends in information technology to ministers and permanent secretaries.¹⁵
106. The very early experience of European cooperation was not as rewarding as there was at first a gap between Iceland’s interests and those of their European partners and it was also expensive for such a small country. Soon however it was agreed that Iceland would take part in the European Schoolnet EUN. Iceland took part in two groups, one on policy and the other on schools. Iceland gained from this in several ways, with a contribution to policy decisions, information on innovations, access to specialists and participation in a wide variety of European projects (personal communication, Jóna Pálsdóttir)¹⁶.
107. Iceland benefitted from cooperation with Britain and large groups of teachers and designers have attended the annual Becta conference to keep up with new developments. Iceland also participated in the ICT league formed in 2001 by the Nordic countries, Canada and the Netherlands (personal communication, Jóna Pálsdóttir).

Policy-making since 2001

Advantage for the future 2001

108. A policy called *Advantage for the future; project plan for the Ministry of Education, Science and Culture for e-learning 2001-2003* appeared in 2001 (Ministry of Education, Science and

¹⁵ <http://www.althingi.is/altext/128/s/0923.html>, 6. grein.

¹⁶ Ávinningur af aðild að Evrópska skólanetinu

Culture, 2001). The policy was expected to look two to five years ahead. The division experts feel that the Nordic cooperation underway at that time had a considerable effect on the direction taken in the policy (personal communication, Jóna Pálsdóttir).

109. In this document released in May 2001 the main emphasis is on ‘distributed education’ and using the internet to increase educational opportunities for individuals and for schools to work together. The notion of a ‘distributed learning school’ is introduced in the minister’s foreword as an emerging idea that will materialise in different forms according to school level and locality. Cooperation between district inservice centres was encouraged in order to support the development of distributed education.
110. It was noted that there was still a need to develop Icelandic materials, especially learning materials, on the Internet and to secure access to these materials (Ministry of Education, Science and Culture, 2001, p. 2). The materials should encourage diversity in teaching and learning. Teachers should receive support on how to guide students at the same time that the independence of students is encouraged.
111. The *Advantage* policy is laid out in several sections in the Icelandic version and an abbreviated form is available in English. The sub-headings are:

Teaching and learning	
Teacher education	Specialised education in ICT
Distributed learning and teleprocessing	Foreign collaboration
Educational content	
Digital educational materials	Quality supervision
Equipment	
Connections	Equipment
Educational gateways	
Educational gateway menntagatt.is	Curriculum guide gateway
Library system	Metadata recording
Information utilities	

Risk with responsibility 2005

112. The next policy document on ICT was called *Risk with responsibility: Policy for ICT in education, science and culture 2005-2008*. It was published in September 2005 (Ministry of Education, Science and Culture, 2005). The development division was again responsible for the review of policy and now linked the policy more directly with what was happening in Iceland. During the preparation phase meetings were held with groups of selected school leaders, teachers, curriculum developers, companies, curriculum writers and others in the ministry. The draft of the policy was not followed up in the same way as earlier policies. Internal restructuring in MESC meant that members of the development division were relocated in other divisions and each division in MESC became responsible for its own IT policy. The policy was introduced in a newsletter (number 9) from the ministry in 2005.
113. In this policy there is a return to some of the earlier themes from 1996, with policy guidelines being extended to culture as in 1996 and science. Five vision statements are introduced:

- access to the information society,
- ICT infrastructure,
- digital content,
- new opportunities and innovative practice, and
- ethics and safety.

For each vision there is a brief assessment of current status, objectives and actions to be taken.

114. Issues of access are again raised with an emphasis on access being available through the Icelandic language. ‘Citizens of foreign descent’ are mentioned. Other ‘marginal’ groups such as women, the disabled, the sick and the urban/rural divide are included in the objectives. A new theme is using ICT to promote healthy living, helping parents coordinate sports and youth activities.

115. Infrastructure objectives range from fibre optics to access to research networks, for libraries and cultural institutions in rural areas. Mobile devices should be exploited further, in education, science and culture. ICT should be used more in vocational and arts education. Schools and cultural organisations should become more active in the production of software.
116. It is suggested that the role of the State Broadcasting Service and its role with regard to DLR should be reviewed. It is worth noting here that the National Centre for Education Materials and the State Broadcasting Service have no agreement on access to or use of materials produced by the other. Digital material should be assessed according to curriculum and pedagogical guidelines. Private and public partnership in the production of materials should be encouraged. Access to databases for research and culture should be facilitated as well as the publication of research from public research centres. The digitisation of cultural content must be encouraged as well as cooperation between cultural institutes, companies and teachers for using digital resources in education.
117. Opportunities for learning are the main thrust of the section on innovative practices, including meeting the needs of individuals and the development of distributed learning and distance learning. Finally issues of ethics and safety are raised, such as copyright issues and the safe use of ICT with children and for learning.

Quality and accountability

118. Quality measures have not been prominent in policy developments in Iceland, though most activities have an indirect measure of quality or accountability. The law requires MESC to evaluate two compulsory school each year for the quality of their education. Included in these evaluations would be questions about adherence to the national curriculum and adaptations at school level. This would cover issues of IT in the curriculum.
119. Schools which receive development funds are required to submit a progress report and a final report on their project activities.
120. It is not yet common for schools to write annual reports but some district school offices are beginning to call for these. Investments in hardware are sometimes accounted for in such reports, e.g. in Reykjavík (Reykjavíkurborg, 2005) but there is little information available on the quality of instruction.
121. Some information is available through Iceland's participation in international comparative studies that could have been or could be used as indicators on the development and use of IT in Icelandic schools. In 1998 Iceland took part in the SITES research with a report being published in 2002 (Thorsteinsson, 2002). This report gives an indication of baseline of activities and views in 1998, just as the ITE-1999 was coming into being. In 1998 it appeared that Iceland was one of the forerunners in introducing and using ICT in schools. A brief follow-up survey was carried out in 2002. Iceland participates in PISA and took part in PISA 2000, 2003 and 2006 and the computer-based survey in 2006. Indicators from these two studies about the status of ICT have not yet been prepared. The ministry also funded an evaluation of the nuclear schools project (see paragraphs 163 to 168).
122. A number of research projects have been carried out in recent years that have obtained funding from competitive research funds (see paragraph 41). Some evaluations have also been carried out such as an evaluation of the nuclear school project (Jónasson, Dofradóttir and Blöndal, 2002), an evaluation of the project on distributed education in compulsory schools in the southern part of the West Fjords (Þorsteinsson, Ingason og Þorsteinsdóttir, 2006) and an evaluation of the development of a new course of study in IT at the Breiðholt College arising from the 1999 curriculum (Kristjánsdóttir og Gissurardóttir, 2003). Evaluations of the distance learning programmes at two secondary schools were also completed in 2003 (currently not available online).

Role of stakeholders in establishing priorities

123. An overview of the engagement of stakeholders in establishing and working with national priorities is provided in Table 2.3.

Summary and implications

124. ICT entered schools at the same time as IT systems were becoming commonplace in society and in economic activities. The 1999 national curriculum gave IT much more visibility than the curriculum of 1989 and encouraged the development of skills and cross-curricular use.
125. The use of ICT in schools is supported by local authorities through investment in resources and training but in schools its use is not yet as widespread as might have been expected.
126. Research in Iceland indicates that teaching practices and the traditional way in which schools are organised through classrooms and timetables constrains innovative approaches to the use of ICT and DLR though creative use is found among individual subject teachers.

Table 2.3 Stakeholder involvement in setting of priorities in ICT in education

Priorities	Policy-makers	Researchers and university students and teachers	Teachers
Identification	At national level the policy-makers have the responsibility for the preparation of the national curriculum and policy statements.	Some international and Icelandic research used in policy development.	Teachers took part in the development of the national curriculum and its revision.
Development	The MESC has followed policy with some initiatives. The NCEM may align its activities with the policy but does align them with the national curriculum.	Graduate education in IT has given many teachers the opportunity to develop activities aligned with the curriculum and also to work on areas not mentioned.	Teachers should adapt ITE-1999 and ITE-2007 to their school curriculum; usually only a handful of teachers are actually involved in this step in most schools.
Application	Indicators for appropriate levels and kinds of ICT use are not well developed.	Some university researchers are involved in graduate and inservice training.	Teachers should follow the school curriculum, which is constrained by factors such as the timetable and teacher capacity in ICT. Learning management systems are used in almost all secondary schools.
Evaluation	The MESC held annual conferences which could be considered to have been opportunities for informal evaluation and formal evaluation of aspects of policy implementation.	Research projects funded by national funds or by universities or both; identify strengths and weaknesses in schools. A number of graduate research projects have evaluated the achievement of some of the ICT policy priorities.	Teachers do participate in research and evaluation projects.

Priorities	Local authorities	Parents	Private sector/grassroots
Identification	After an evaluation (IMG Gallup, 2005) the city of Reykjavik prepared a plan for strengthening the ICT skills of teachers, which included inservice training for basic IT skills.	An association for cooperation between homes and schools has participated in a project on safe use of computers (SAFT project) and have thus had an influence on <i>Risk with responsibility</i> .	Example: A private company Mentor identified a need for ICT support for school administrators and learning management and set out to develop such support. The need for more DLR, in line with policy, has been identified by several groups (Cases A.3, B.4, B.5, B.6)
Development	Local authorities should work with the policy statements in providing appropriate support for schools for implementation.	The use of LMS and the increase of school websites has enabled parents to have more information on schools and in turn this has given parents a greater say in school developments.	Mentor has developed its system. DLR developments compete for project grants or develop subscriber schemes (parents, schools) or both.
Application	There are examples of local community support to implement policy: some proactively.	The idea of 'distributed schools' was generally supported by parents in rural communities.	Mentor has applied its management system in cooperation with schools. A wide range of materials.
Evaluation	Example: The city of Reykjavik has carried out an evaluation of computer skills found in schools.		

CHAPTER 3: ASSESSMENT OF THE ICT POLICIES IN EDUCATION

127. The purpose of this chapter is to review the developments in the three main pillars of ICT policies in education: infrastructures, training and content development during the last ten years or so, at national and at local level. Activities aimed at content development will also be addressed in Chapter 4. Finally, the dissemination of research and development findings is also considered in this chapter as they promote discussion on development involving ICT and DLR.

Alignment between national policy and education policy

128. In 1998 status reports were submitted by ministries to the central project team coordinating the *Vision of the Information Society* (Prime Minister's Office, 1998).
129. The report from MESC listed an extensive range of activities underway (Prime Minister's Office, 1998, section 3.10). Topics listed included: the new curriculum, the first IT conference (see later), grants for the development of software, the establishment of nuclear schools (see later), a database of and for the Icelandic language, the preservice and inservice education of teachers, graduate programs in several universities, development funds, the targetted research program on IT and the environment, a needs analysis for a knowledge/information site, cooperation with OECD, the development of a distance learning framework and other related developments, cultural and conservation issues, Nordic cooperation and a variety of work groups and committees. In Figure 3.1 an overview of some of the infrastructure and training developments regarding ICT in education from 1995 onwards within the context of key national policies is shown.

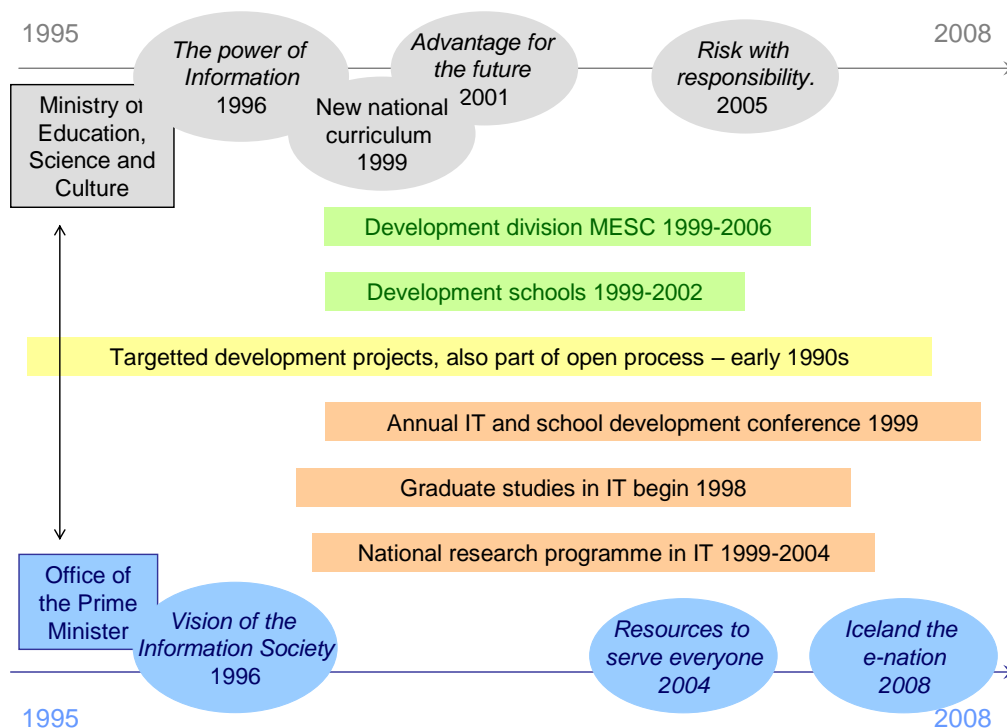


Figure 3.1 Key national policy documents and formal activities regarding ICT in education

Investments in infrastructure

130. There was a major investment in infrastructure by the MESC through the preparation of the national curriculum. The general direction to be followed was clear after the publication of *The power of information*. Information technology was considered to be a valuable resource for learning; skills needed to be developed and it was to be used in all subjects.

131. The publication of the national curriculum was accompanied by the establishment of the development division in MESC which was to be a unit dedicated to developing IT in schools. IT thus was singled out for particular development. At its peak the division had three full-time officials, who managed the development schools project, worked on the development of the Educational Gateway, served on national and international committees, liaised with other departments in the ministry, worked with an outside agency on the annual conference and worked on renewal of policy (see previous chapter).
132. One of the major cooperative projects undertaken by the division and a major investment was the establishment of a secondary school in West Iceland that was built on the concept of 'distributed learning' as it appeared in the policy *Advantage for the future* in 2001 (Jóna Pálsdóttir, 2005).
133. The decentralisation of compulsory school administration to local authorities in 1996 had a detrimental effect on database activities. With this change in function in the mid-1990s much of the centralised collection of information on school activities in Iceland disappeared and only in recent years has the Association of Local Authorities restarted centralised data collection on more than the costs of running schools. The numerical information that is available comes mainly from Statistics Iceland, a national bureau charged with the systematic collection of all kinds of information.
134. The MESC continued to carry out its role of maintaining the national curriculum and retains a monitoring role. A few schools at all levels are selected for intensive evaluation each year. The MESC is also responsible for assessing at five year intervals the extent to which schools carry out self-evaluation on all aspects of the work of the school, including the curriculum, teachers and other resources.
135. The largest local authority (Reykjavík) was led for many years by a director who prioritised the annual or bi-annual collection of data from schools in order to provide indicators of progress being made. In the annual reports from the central educational office it has been possible to follow the upgrading of computer facilities in schools and the provision of centralised computer services to all schools. In one local authority (Garðabær), ICT advisers have been employed within schools.
136. Although in the 1980s a number of computer options were available, including the Apple, the BBC computers, the Sinclair and some IBM models, school computers are mainly those which use the Windows operating system, with several brands available, though a few schools have built their services up around the Macintosh system from Apple.
137. Microsoft Windows was popular by the mid-1990s and the possibility of the company creating an Icelandic version of Windows for use in Iceland was soon discussed. It was considered particularly important that compulsory schools should be working in an Icelandic IT environment. This request was met in 2004 when Microsoft delivered an Icelandic version of Windows to the Minister of Education.¹⁷
138. In the winter of 2006-2007 it was still possible however to visit schools, particularly in rural Iceland, that did not have computers in every classroom or easy access for students and staff to the internet (own research). The level of service provided to schools can also vary between towns, especially the smaller ones, and a breakdown in electricity supply has been known to put a school computer system out of use for several weeks. Data projectors are increasingly common in schools, and in some cases, can be found in permanent positions, though often they must be booked ahead of time and carried to the classroom. Many schools have one or two computer laboratories which are used for whole class teaching, particularly of ICT skills. Almost all secondary school students own their own laptops. Some compulsory schools have invested in portable sets of laptop computers. Although providing more opportunities for teachers who have not booked the computer laboratory, their use has been hindered by practical management such as opening and closing the sets at the beginning and end of lessons and for the need for someone to take on the responsibility to recharge the sets regularly. Better access

¹⁷ <http://www.menntamalaraduneyti.is/radherra/raedur/2004/08/13/nr/2749>

for teachers to computers has changed their preparation of lessons and delivery. E-mail contacts between teachers and parents, and teachers and learners, also brings new demands to the learning situation.

139. A European benchmarking activity on ICT in schools in Europe published a report on Iceland in 2006 (Empirica, 2006). The figures in the Icelandic study are based on interviews with 177 principals and 424 teachers. According to this, about 90% of compulsory schools had a broadband connection, making Iceland one of the highest ranked countries in Europe. Around 60-70% use a LAN or intranet service and about 35% think that better technical support and maintenance are needed. Computers are found in about half of the school libraries (47-61%). About 36% of teachers use computers in less than 10% of lessons and about 41% in more than 50% of lessons. 87% of teachers rely on existing online materials (more than most other countries), 56% use CD ROMS (less than in other countries) and do not search as often as teachers in other countries for new materials (69%).
140. The largest barrier in Iceland to the use of computers in classrooms is often said to be a lack of computers (36%). Very few (3%-4%) of teachers feel that the lack of material online or in Icelandic hinders use of computers and few (5%-7%) think that a lack of teacher interest or skills is a barrier. About 40% think however that existing materials on the internet are of a poor quality. However about half the teachers (twice as much as the European average) think that the content of their subject does not lend itself to the use of computers. Interestingly though between 70% and 90% think that computers can be used for drill and practice, for retrieving information independently, as an office tool and for collaborative or productive work by pupils.
141. The benchmarking report suggests that the lack of access to computers does not constitute a problem. Rather, the lack of motivation of teachers does, with about 37% of teachers (the highest in Europe) with the necessary access and ICT skills, not motivated to use it in the classroom (Empirica, 2006). In all about 18% of Icelandic teachers seem fully ready to use computers in class. It should be noted that one interpretation of these results is that more teachers in Iceland than elsewhere have actually worked with ICT and thus have experienced first hand both barriers and incentives to the use of ICT.

Investments in training

Inservice training

142. Another consequence of the decentralisation of compulsory school management was a change in the way inservice training was organised. Up until about 1997 most inservice training was managed by a special department at the Iceland University of Education. On an annual basis this department prepared a set of courses to be offered in the summer or over the winter and until 1995 the department was also responsible for paying for the board and lodging of teachers attending courses. It was an offshoot of this department, now attached to the university but financially independent, which was asked to provide training in computer skills around the country after the publication of ITE-1999. This set of courses reached 342 teachers in 21 courses, 10 of which were held outside Reykjavík (Lemke, 2005)
143. By the late 1990s the Inservice Fund previously mentioned had been established and schools and school districts had to get used to the idea of identifying the kinds of courses they wanted and developing them into project proposals which competed against other proposals. For the last five years this fund has paid for the teaching costs of from 87-112 courses, with an annual budget of between 17 and 20 m.kr. It must be noted though that only 15 out of more than 400 courses funded in the last five years have titles reflecting the use of IT in schools (information from press releases from the ministry¹⁸). Most compulsory school principals and some district offices now set aside in addition some of their local budget allocations for in-house projects requiring training and for individual teachers who may need some specialist training. The MESC ran many ICT courses for teachers in secondary schools in the early 2000s.

¹⁸ <http://www.menntamalaraduneyti.is/afgreidsla/sjodir-og-eydublod/menntamal/nr/1824>

144. The ministry and a research project supported the development of an instrument for the self-reporting of ICT skills by teachers has been discussed (Lemke, 2005). The results were used by principals to meet training needs and plan in-school courses.

Teacher education and graduate studies

145. Teacher training and graduate studies have also played a role in the training of new teachers or those seeking new skills. At the Iceland University of Education (IUE), the largest teacher education unit with about 140 academic staff and about 2500 students, there is a long tradition of using ICT in learning and teaching. For example, in 1993 the IUE took advantage of the newly established network in schools *Ísmennt* and developed a distance learning B.Ed. degree package (as discussed earlier) which used e-mail and was at first offered mainly to teachers in rural areas, but which is now open to all. The distance learning package offers the same courses which are taught on-site, but currently uses systems such as WebCT Blackboard, Camtasia and Moodle in providing training to undergraduates, many of whom are teaching in schools. The use of ICT is built into all courses, whether on or off campus, and a specialisation in ICT is offered in the undergraduate program, though only a small group usually chooses this option.
146. The establishment of a graduate studies program in 1998 has been important for the introduction of ICT innovations into schools and for increasing the understanding of what is possible and what is necessary. Many have graduated with 30 or 60 ECTS diplomas and a good number have gone on to research-based master's degrees (Appendix II). The graduate studies program leader has actively encouraged students to apply for grants from research and development funds.

Views of school leaders and teachers

147. In a recent survey in Iceland Elvarsdóttir (2004) considered the question of whether the views of school leaders on ICT had an effect on the way its use was developing. The use of ICT was considered widespread by both leaders and teachers. Leaders' use was however more varied and more frequent than that of teachers. Schools were considered to be generally well-equipped, with good services and good support and provision of continuing professional development. The study indicated that there was however limited use of Internet and specialised teaching packages in teaching itself. Only 12% of teachers said that they used the internet a lot in teaching and only 10% used teaching programs a lot. Very few teachers accept assignments by e-mail, a full 86% never do. Older teachers are less likely to use ICT. While 97% of leaders said it was important to integrate ICT into teaching, only 16% of teachers felt the same. We see here that there are differences in demography, mobility and attitude – teachers tend to be conservative with regard to using ICT and are sedentary and older, while school leaders are more progressive and are more likely to be moving into new positions and schools.

Investments in digital learning resources

The National Centre for Educational Materials

148. Each school is required to prepare a school curriculum based on the national curriculum adapted to their own strengths and circumstances. The main provider of printed materials has been the National Centre for Educational Materials (NCEM, see Case A.2) which has for many years offered a variety of teaching programs, particularly for special education. In the last ten years or so it has been adding to its DLR range, much of which is support material for its printed materials.
149. In 1999 there were 20 titles on the NCEM website but by the end of 2002 they were 95. In 2000 additional funds of 25 m.kr. were provided to the NCEM because of the new national curriculum and another 36 m.kr. specifically to produce teaching software, much of which went to web-based materials, for example, there were 19 new titles in 2000. In 2001 there was emphasis on ITE and life-skills. Multimedia disks were produced and 40 new digital titles. The decision was also taken that year that in future all teacher support material was to be published only on the net for printing out by teachers in their schools. In 2001 23,7 m.kr. went to

- curriculum material, thereof 10 m.kr. special funds earmarked for DLR (Námshagnastofnun, 2000, 2001).
150. In 2002 there were 18 new digital titles, both disks and web materials, at the cost of 16 m.kr. where the total budget was about 350 m.kr. A survey of web use showed that there were about 600 teacher visits a day. Teachers went online to look for announcements about new off-line printed material and to find teacher guides. In 2003 nearly 15 m.kr. went to digital material (Námshagnastofnun, 2002, 2003).
 151. In 2004 the development of interactive material was emphasised and materials to be printed out in schools. Examples included the subject areas of music, biology, English, Icelandic and IT skills. New digital material was publicised especially through pamphlets. A digital news and special events feature *Í dagsins önn* was created and a special editor appointed (Námshagnastofnun, 2004).
 152. In 2005 there were 50 new digital titles, many of which take advantage of digital possibilities. New titles included music and webs on environmental education, on citizenship and democracy and on life-skills for younger children. There 23 interactive titles, five titles of materials to be printed out, 23 sets of teacher guidelines and five learning webs. In all 17 m.kr. went to digital material, in a budget of 368 m.kr. (Námshagnastofnun, 2006).
 153. The NCEM digital material is usually of a high quality and the editors employed by the centre usually publicise new material at autumn meetings of teachers in different parts of the country and teachers and others can subscribe to an electronic newsletter which brings announcements of new materials.

Information on and access to resources

154. Until the decentralisation of compulsory schools, there were eight district education offices in the country, all but one of which ran small resource centres. Teachers could meet at the centre for short courses, sometimes run by NCEM staff. The resource centres in some cases had considerable collections of teacher-prepared materials. When visiting the centres, rural teachers would look through both NCEM and other materials, pick up teacher videos, get tips on the use of teaching programs and chat to the teaching advisers. Immediately after decentralisation there were over twenty education offices, only a few of which decided to maintain and run resource centres.
155. The NCEM itself ran a large resource centre until 1992, when it was moved to the IUE. In the centre short courses were held, new material was presented to teachers and there was a large supply of teacher-prepared materials on hand.
156. With increasing use of the internet and more resources being available online, the need for the resource centres seemed to diminish. Teachers continue to develop their own materials and some of them put them online. Issues of access and copyright have sometimes complicated distribution of materials and in many cases the materials are pdf copies of printed material.
157. There is open access to all the digital material published by the NCEM (case A.2).
158. A fairly new provider of DLR is the School Web (see Case A.3), which began as a small teacher-initiated project in 1999, and is now a major supplier of materials to schools. Some of the School Web resources have been funded by MESC grants and some of their materials are open to all. A subscription to the School Web ensures access to a much wider range of resources. The Educational Gateway (Case A.1) on the other hand has built up a database which links teachers to free resources and thus School Web materials cannot be found in the Gateway database.
159. The feasibility of the Educational Gateway (Case A.1) was being informally assessed by one of the MESC officials through private graduate study as the *Advantage for the future* policy was being formulated. The original idea had been the establishment of a teaching centre but this was a direction that the minister did not want to follow, as it involved both staffing and investment. The idea was downsized to a national portal which was at first managed from the MESC but has

since been outsourced. With the disbandment of the department for development it has been necessary for the Gateway to diversify its activities in order to finance its core activities.

The UT conferences

160. Annual conferences were held by the development division at the ministry for eight years. They were aimed at practitioners and several times the number of participants exceeded 1000. They were held at a different site each year, often in large upper secondary schools. It is probably safe to say that most key players in the country attended the conferences at one time or another – officials from the MESC and NCEM, teachers, advisers and principals from schools, university staff and not least, the private sector, which used the opportunity to promote new hardware and software. By 2002 more of the presenters were from compulsory schools than secondary schools, and many had received grants from national funds or local authorities.

161. Well-known experts in the field were invited to give plenary lectures and run short workshops. Here is an example of the type of program offered. Presenters in 2000 included:

The Minister of Education,
 Alfred Borke from the University of California, Terry Mayes from Glasgow
 Caledonian, Jaun Gutierrez from California State,
 Senior officials from the OPM and the MESC and from NCEM,
 Participants in a Nordic project and in a European project,
 Researchers from the Iceland University of Education, the University of Iceland, the
 University of Reykjavík, Bifröst and the University of Akureyri,
 The Association of Industries,
 From private and public companies such as Nýherji, Tæknival, Prím ehf., Hugvit, Skýrr
 and Landsími Íslands, SmartVR,
 Members of parliament,
 Teachers and students at upper secondary schools,
 Adult education centres,
 Local authorities.

162. This annual UT conference is no longer held, though there are several other conferences each year on research and development in education and the social sciences in which IT researchers have taken part (see paragraphs 177, 179).

The ‘nuclear schools’

163. One of the major undertakings by the MESC was the running of the ‘nuclear schools’ project. This project was evaluated by a team of researchers from the University of Iceland in 2002 (Jónasson, Dofradóttir and Blöndal, 2002).

164. The role of the nuclear schools included the development of methods of using IT in teaching and the work of the school and providing advice on the design and production of teaching software and testing the products in their own teaching. Other roles focused on training of staff and students, giving advice to other schools and providing places for trainee teachers.

165. The evaluators found that the schools found it particularly difficult to focus on the development of methods of using IT, in part because both teachers and students lacked basic IT skills. They did however find that teachers used the internet in a number of ways, which included students producing their own websites, and that they used a variety of teaching programmes. The teachers noted however that IT was less likely to be used in teaching itself and more likely to be used in preparation and administration. Using IT in teaching made considerable demands on teachers, being both time-consuming and difficult (Jónasson, Dofradóttir and Blöndal, 2002).

166. The proposed relationship between the nuclear schools and the NCEM did not work out, for several reasons, including poorly defined objectives at the beginning and the fact that the schools themselves were not included in the process of the setting of the objectives which had been in the hands of the MESC. The same can be said about opportunities for teacher trainees, though in this case no arrangements were made by the MESC with teacher training organisations.

167. Nuclear schools were to carry out standardised surveys each year and to submit annual progress reports. Neither of these assessment processes were carried out successfully by all schools, which in some cases changed the survey to suit the needs of the school and in other cases reports were not submitted or were poorly structured.
168. The evaluators pointed out however that the ‘nuclear school’ project was well-accepted by staff in all the schools. It was difficult however to say for certain what gains could be attributed to the project as many other schools not involved had achieved considerable progress in using IT over the same period (Jónasson, Dofradóttir and Blöndal, 2002).

Local authorities and national policy

169. Some local authorities have had an influence on whether the national policies are followed or ignored. The City of Reykjavík commission in 2005 a survey of the use of ICT in city schools (IMG Gallup, 2005) and followed it up with a dedicated inservice package on learning ICT skills, *Töluvtök*. The increasing numbers of computers in schools, and hence number of computers per student, have been listed in the annual report on education in Reykjavík as indicators of progress. During the period of the study the evaluators visited 200 classrooms and in over 90% computers were not being used. Computers were most often being used in IT lessons and in art and other practical subjects. About 30% of the teachers had not used the computer in any way for the lesson being taught, about 60 had used the Mentor administration system (see below). About 16% had used the internet and nearly 6% power point slides. About 38% of teachers would like to see 3-4 computers per classroom, about 30% would like to see them in dedicated computer rooms and 22% in so-called ‘islands’ around the school.
170. The educational services provided by the peri-urban community of Garðabær have been strongly aligned with ICT policy in education. In 1999 the education office wanted value for money and in cooperation with a member of staff of the inservice organisation at the Iceland University of Education, a scheme was developed to assess the self-reported ICT skills of teachers and to provide school principals with advice on how best to allocate funds for ICT training of teachers (Lemke, 2005). As part of the same development, the community then funded ICT teaching advisors in each of its three schools and provided schools with sets of portable laptops to be used in classrooms, and provided teachers with their own laptops.
171. Similarly, in the community of Árborg in the south of Iceland, there has been district-wide support in line with the policies of the Information Society¹⁹ for managing the local authority and for developing and using ICT in schools. Several individuals in the district have over the years applied successfully for grants using ICT. Two schools, one compulsory and one secondary, participated in the ‘nuclear schools’ project (Jónasson, Dofradóttir and Blöndal, 2002). The principal of the compulsory school felt that one weakness in the national policy had been to mandate pupil use of ICT rather than beginning with teachers (Macdonald, Hjartarson and Jóhannsdóttir, 2005). This school worked in cooperation with the NCEM and trialled learning software (Jónasson, Dofradóttir and Blöndal, 2002).
172. The instrument mentioned earlier that was used for self-reported ICT skills (Lemke, 2005) was developed with partial funding from the MESC and later further analysis with funding from a project LearnICT funded through the targetted research program on IT which had been introduced in 1999. The instrument was built on behavioural scales rather than a Likert approach and was used by principals around the country. In all about 1300 teachers answered the questionnaire. This example is one of several in which the smallness of Iceland and relatively close links between policy-makers at national and local level led to interventions in line with policy.
173. Many local authorities in Iceland have bought services from Mentor, a privately owned company and provider of *Mentor.is*, a web-based management information solution for schools, which has been on offer since 2003.²⁰ Mentor.is is designed to serve the whole school community. It provides a service for principals and teachers in their administrative work

¹⁹ http://www.arborg.is/news.asp?id=258&news_ID=1242&type=one

²⁰ <https://mentor.is/MentorVefur/UmMentor.aspx>

through coherent reporting systems and channels for information flow within the school as well as to the students and parents. The system had its origins in a program which facilitated timetabling in schools which entered the market in 1990.

174. The Mentor managers suggest that what differentiates Mentor.is from other MIS systems is the strong focus on personalised learning, individualised evaluation and communication with parents. It manages processes such as attendance, timetables, exams and individual learning plans and evaluation. The latter development received project funding from The New Technology fund in Iceland. The system is written in Net and on an Oracle database. Parents use the system in increasing measure. During the school year 2007-2008 there were about 20000 parent visits per week (personal communication, Mentor, 2008). The company has recently entered the Danish and Swedish markets.

Dissemination of research and development findings

175. Over the period 2003-2005 an evaluation of educational research and development in Iceland was carried out (Rannís and Menntamálaráðuneytið, 2005). One of the general findings was that more consultation was needed from the selection of research topics to the dissemination of findings. It was also noted that the interactions between research and development could be enhanced.
176. In the period 1998-2002 (five years) about 10% of the projects funded by the national Development Fund involved ICT. In the evaluation it was noted that the fund's advisory committee at the time preferred to fund grassroots projects rather than those originating from research. Over the same period 1998-2002 just less than 5% of publications arising from university research projects were in the area of ICT, with almost all of these originating in the IUE. A general finding of the evaluation was that about half of all publications in educational research were actually conference presentations.

Conferences on research and development

177. Each spring from 1999 until 2006, MESC held an annual conference on IT. The programme was practitioner-oriented with examples of innovation practice being a large part of the program. (More details are in paragraphs 160 to 162.)
178. The IUE has held an annual conference on *Research - development - innovation* each autumn for the last eleven years. The number of talks related to IT peaked around 2000-2002. This conference has traditionally had more emphasis on research than the IT conference had.
179. In 2002 an association for educational research (FUM) was established and there have been opportunities to present research findings at three conferences, held in 2003, 2005 and 2008.

Journals

180. The association for educational research (FUM) has established a journal in which several research studies on ICT use have been reported.
181. There are two other peer-reviewed journals on educational research in Iceland, one of them being an online journal *Netla* whose establishment in 2002 was initiated by ICT academic staff at the IUE.²¹ This is a popular journal which has about 20-30 articles a year, of which some are related to IT. The other journal was established in 1992 by the IUE and in recent years has been a cooperative project with other universities.

Graduate studies and university research

182. An important avenue for dissemination comes about because of assignments carried out in the IUE graduate studies program in ICT. Most of the assignments are shared with other students online though not necessarily to the general public. The director of the graduate studies program in information technology has encouraged what she has termed 'distributed research' whereby

²¹ <http://netla.khi.is/>

graduate students participate in research projects by collecting data in their own school and analysing that data, at the same time that they make a contribution to a larger project and add to the database (Jakobsdóttir, 2004).

183. As mentioned earlier the establishment of the program has led to a fair number of students completing master's research projects (see Appendix II) but only some of these students have publicised their findings elsewhere. The research topics include whether ICT is being used in the art curriculum, the use of ICT in special needs, finding out how capable users of ICT became capable, the use ICT in pre-schools, the assessment scheme already mentioned, the views of school leaders on ICT, using ICT to manage schools, the creation of a web for use in art teaching, and using the internet in teaching literature.
184. Several educational projects received funding under the targeted research programme mentioned earlier. The largest of these projects LearnICT (carried out from 2002-2005) assessed what using ICT might mean for teaching and learning.²² A detailed website with all project documents and conference presentations and papers written by the team was developed. The project involved about twenty researchers, both staff and students, who studied the use of ICT in pre-schools, compulsory schools, upper secondary schools and universities. Among the final publications are a set of short digital interviews on different issues arising from the use of ICT, taken on-site in a pre-school and compulsory schools and edited into short presentations.
185. In June 2008 a research centre on ICT in education²³ was established

Summary and implications

186. The 1996 policy document *The power of information* (discussed in paragraphs 78 to 81) laid out activities and aims in efforts to bring ICT and the use of DLR into schools. Much emphasis was placed on the development of software, with the NCEM to have a key role, though others would also begin to produce materials. Teacher education would help train teachers in the use of ICT and support would be provided for school leaders to keep up with development. Guidance would be found in the experiences of schools in the 'nuclear schools' project. Schools would facilitate the use of ICT through timetables and the placement of hardware and research on the effect and use of ICT would be carried out.
187. It is extremely difficult to find figures for investment in infrastructure but it is generally accepted that local authorities have in general found the provision of suitable computers to be expensive but necessary. Likewise the local authorities have generally supported training of teachers in ICT and teacher education has also played its part, not least in educating those who wished to specialise in ICT and return to their schools after graduate studies.
188. The level of funding provided for DLR in a small country is an issue. In Iceland this affects on the one hand public organisations such as the NCEM, as well as private companies which compete for government funding, but also get schools to subscribe to their services. It would seem that the decentralisation of schools to local authorities and the provision of DLR are not activities which fit well together. The specialist knowledge required to produce high quality DLR coupled with the smallness of the Icelandic educational system and its language and culture might need more centralised well-funded support than anyone imagined in 1996. The knowledge of teachers and the frame of mind needed to use DLR also demands special attention as the widespread acceptance of new ways of learning, envisaged in the 1990s, has not materialised. The uptake of DLR will be explored further in the next chapter.

²² http://namust.khi.is/in_english.htm

²³ <http://wp.khi.is/rannum>

CHAPTER 4: DLR AND EDUCATIONAL INNOVATION

189. The objective of this chapter is to describe and review the current status of DLR and their impact as system-wide innovations.

Learning resources

190. The idea of a learning resource that is specifically digital has emerged slowly, with more attention being paid to learning resources in general. For example, in the national curriculum in 1999, there is only a general discussion of learning resources, which have been officially translated as instructional materials:

Instructional materials include printed matter, such as text, books, reference books and guides of various sorts; visual materials of various types, such as photographs, films, videos and posters; audio material such as tapes and CDs; computer programs; internet material; multimedia content; material for practical instruction; etc.

191. Materials are to be closely aligned with the national curriculum. Several criteria to be used in their production are mentioned and the promise of IT and the need to become familiar with it is made clear:

Instructional materials should be varied and conceived with care, should increase pupils' knowledge, deepen their understanding of themselves and their surroundings, train them in various ways of working and encourage them to develop healthy and positive attitudes. Instructional materials exploiting the newest information technologies both communicate knowledge and train students in working methods which will serve them in their lives and work.

192. Research done in middle school classrooms in Iceland nearly 20 years ago showed that printed materials, usually from the NECM, are used by teachers for the major part of every lesson (Sigurgeirsson, 1992, Macdonald, 1993). Recent research, some of it unpublished, indicates that 15 years later the same types of teaching practice are observed, i.e., printed materials are the mainstay of classroom lessons. Although science teachers used some experimental equipment few other additional materials were used in physics and chemistry, biology teachers used films, models, slides, wallcharts and even the computer, way back in the late 1980s (Sigurgeirsson, in Macdonald, 1993). Thus DLR have had to find their way into school practices that rely heavily on textbooks, though in recent years, there seems to be increasing interest in outdoor education.

Policy regarding digital learning resources

193. Iceland does not have a definitive policy statement regarding DLR but the development and use of DLR has been mentioned in most policy documents published since the mid-1990s. To begin with the main proponent was the Minister of Education himself. Under him the first policy document *The power of information in 1996* appeared and he gave support to development funds, the running of the 'nuclear school' project and the preparation of new policies on ICT in education.
194. The underlying promise of all the policies since 1996 has been that using DLR would facilitate innovation through new opportunities, a vision and new ideas. The national curriculum stated "The enormous advances in this area have changed many aspects of work and society. Each subject must take advantage of the opportunities which information technology offers to achieve its own objectives" (Ministry of Education, Science and Development, 1999, p. 20).
195. In an MESC policy statement in 2001 it was stated that "educational materials shall be imparted purposefully and communications established between students, teachers, school administrators, parents, employers and all those connected with education. This vision entails that traditional teaching practices develop into what may be called distributed education, with students engaging in studies in distributed learning schools" (Ministry of Education, Science and Development, 2001, p. 2).

196. In a policy document from the Office of the Prime Minister in 2004 it said “A major effort shall be undertaken in creating curricula based on new ideas for applying information technology in the field of education, and conditions shall be created for competition in compiling study materials. Digital cultural materials will be used to a growing extent when preparing educational materials” (Prime Minister’s Office, 2004, p. 20).
197. In the policy *Iceland – the e-nation* from 2008, measures to be undertaken in education are listed under the heading ‘progress’ (Prime Minister’s Office, 2008). Measures to be taken include the increased use of ICT, in part with support from IT-leaders, development of personalised online examinations, and development of digital educational materials for compulsory and upper secondary schools (p. 12-13).

Funding for DLR from the national budget

198. The National Centre for Educational Materials (NCEM) has had the official task of producing materials for compulsory schools for over 25 years. In 2000 and 2001 it received additional funding in order to develop new curriculum and in particular digital materials. The level of funding to the NCEM in recent years has been about 350 m.kr. with DLR receiving amounts of around 20 m.kr., with or without special grants (Námshagnastofnun, 2000, 2001).
199. The NCEM itself decides on its own priorities and how it will address DLR. In its annual report from 2001, the director stated that their policy was to develop DLR that used the possibilities the computer has over printed books rather than offer texts to the pupils to read on the screen which could just as well be published on paper. In this way would DLR become an incentive to learning and improve it (Námshagnastofnun, 2001). Many web materials are related to printed texts but provide additional possibilities, such as sound or visual images. There are also several independent webs, some of which are very popular and accessed by the general public. The NCEM notes sometimes that the webs can be used for independent study or by pairs of learners. According to the director, using DLR makes demands on teachers as it requires new teaching methods (Námshagnastofnun, 2003). Much of what the NCEM classifies as digital material is actually in a pdf format for printing out by teachers for their own use or for use in classrooms.
200. In the early 2000s the development division at the ministry began to develop the Educational Gateway, the national portal (Case A.1). It was proposed that the portal would include access to teaching and learning materials, and furthermore that these would be linked directly to the national curriculum. In 2003 the ministry decided to allocate project funds to the total value of about 7 m.kr. to the development of interactive material for the Gateway and this decision was advertised in 2003. In all 20 projects received funding both in compulsory and secondary schools. The grants committee looked for multimedia and/or interactive projects which were not too expensive from reliable developers. The NCEM itself received 0,9 m.kr. for interactive mathematics and the School Web (Case A.3) 0,65 m.kr. for a history and an English project. Two projects were related to music and four to science. One was for computer studies in secondary schools.
201. In 2006 the MESC allocated funds to a call for the development of digital and interactive learning resources in the key areas of Icelandic, mathematics, English and Danish, which were to be aimed at users at the transition point from compulsory education to upper secondary. The project was managed and publicised by the Educational Gateway. It has been a policy of the present minister to create more flexible opportunities for students entering the transition from compulsory to secondary school. Sixteen DLR projects were awarded funds and their products presented to the public in late 2007 at a conference. This call for projects was also in accordance with one of the recurring themes in policy over the last 10-15 years, i.e. the development of Icelandic software.²⁴ The knowledge base for DLR innovation varies between initiatives. For example, the NCEM encourages its editors to attend conferences such as Becta in the United

²⁴ The Icelandic case studies will consider in more detail some of the organisations and individuals who received grants in 2003 and 2006. For example, the commercially run School Web received four grants (Case A.3), the National Centre for Educational Materials (NCEM) four grants (Case A.2), the Katla project one (Case B.5) and another project sought some of its ideas in the IceKids project (Case B.6).

Kingdom and some of the editors have had graduate training in IT. Evaluation of prototypes is however largely informal. Leaders of the language projects in the case studies have undertaken graduate studies in aspects related to their projects (Cases B).

202. The Information Society project run by the Prime Minister's Office allocates some of its funds to education, which are then administered by MESC. Recently it was announced that measures to increase IT leadership, as identified in the 2008 policy *Iceland – the e-nation* (see paragraphs 50 to 53, 202), would receive funding of 50 m.kr. over the next four years and the the development of digital materials would receive 65 m.kr. over the same periods. The development of personalised examinations would receive 25 m.kr. and web materials and a picture dictionary for immigrants 25 m.kr. The rationale for these measures was prepared by MESC in 2007.

Accumulation of knowledge

203. No particular organization in Iceland has a mandate to accumulate and organize knowledge regarding ICT use and DLR. This function is distributed across universities and a professional association.
204. The professional organization is called “3F – Association of IT and education” which was established in the 1980s and was then called the Association of programmers in education. The notion of IT itself had not yet arrived. The 3F association holds meetings and conferences and maintains an active website http://3f.is/index.php?option=com_frontpage&Itemid=1
205. A small core of academic and professional staff at the Iceland University of Education (IUE)²⁵ is responsible for teaching IT in education and the professional studies committee discusses issues arising in pre-service teacher education curriculum and in graduate studies. Several members of staff are active researchers in the area of IT and recently formed a research group²⁶. Some individuals have been active in the development of distance learning policy and procedures at the IUE, and have taken part in the development of a distance learning policy for the new institution which will be formed in July 2008 when the University of Iceland and the IUE merge. Some of the staff have extensive knowledge and experience in ICT applications, and are able to use this in their work with students. Graduate students undertake a variety of small projects using multimedia applications. As mentioned above, a research centre on ICT in education has been established.
206. There are also IT departments at several other universities in Iceland where individuals have carried out research in the area of IT in education. One IT specialist was until recently employed by the NCEM.
207. The largest local authority recently used material from Denmark as the basis for an inservice program, *Tölvutök*, in using IT in teaching. Schools in the district and in other districts could enroll in the program. In 2006-2007 13 schools in Reykjavík took part and 394 teachers, 180 of which completed the program in spring 2007. In the rural district of Skagafjörður more than 80 teachers took part, almost all of whom completed the course. Teachers work in small group assignments and work on their own on exercises. They are encouraged to relate the assignments to their immediate teaching as much as possible. In an evaluation by teachers at the end of the first year, several positive aspects were mentioned, including the ease of use, the variety of topics, pacing according to individuals and the relationship to actual teaching. There were however negative comments which ranged from being too easy to being too difficult, but some also found it difficult to make sense of the Danish instructions.
208. As mentioned above, over the last decade or so many students have completed research projects for their master's degree and their findings are often of great interest and much used by practitioners in the field. A list of students at the Iceland University of Education and the names of their projects are to be found in Appendix II, as well as some from the University of Iceland. Other projects have been carried out at other universities in Iceland and abroad. Some master's

²⁵ Merged with the University of Iceland in July 2008.

²⁶ <http://wp.khi.is/rannum>

projects were associated with the LearnICT research project carried out from 2002-2005 with funds from the targeted research program on ICT discussed earlier. Some projects received funding from other sources, including paid research leave provided by the Association of Local Authorities or by the Teacher's Union.

209. As mentioned in Chapter 3, UT conferences funded by the ministry and private sponsors were held from 1999 to 2006. The MESC also had conferences in 2002 on the nuclear schools project and in 2007 on the digital learning resources produced with grants from 2006 (discussed above).

Incentives and user-driven innovations

210. There are few real incentives for the production of high quality digital learning resources by users. Individual teachers across the country have been however the grass-root innovators, developing DLR solutions to problems that they face in their immediate teaching. Within teacher education students in some lines of study might be expected to submit graded assignments in a digital form which they may be able to use later in their teaching. Some materials published by the NCEM have been developed by teachers who then submitted their products to NCEM editors for possible publication, though this is not common in the case of DLR.
211. Two of the case-studies to be considered (the Educational Gateway and the School Web) provide access to DLR and have encouraged teachers to provide access to the learning resources which they have developed. The Gateway provides free access to links to materials produced elsewhere. The School Web provides access to their own materials, some of which are free and others require a subscription. In both cases some of these materials are pdf versions of worksheets which in earlier times would have been stenciled or photocopied for use by others. However others are innovative and offer resources which transform teaching and learning opportunities. As mentioned earlier, the internet has to some extent replaced the earlier sharing of materials in resource centres.
212. One of the findings of a case-study carried out as part of the evaluation of educational research and development 2003-2005 was that development work in schools was related sometimes to the working atmosphere which in turn depended to some extent on the school principal (Snævarr, 2004). In new wage agreements principals had been given some control over the non-teaching time of teachers. The total time was reduced in a later agreement but the clause brought about fundamental change in school management. Some principals give staff some flexibility, others want all time to be accounted for. Some principals do not want any work on a project to be carried out before a grant is received, while others consider a grant as a reward rather than a condition.
213. Some DLR in Iceland can be attributed to emerging situations, such as multiculturalism (Fjölmenningar vefur) and the increase of children with Icelandic as a second language (Case B.5). Sometimes previous IT experience plays a role in which IT skills and teacher training can be put to educational use, for example, in the Rasmus sites.²⁷ There are also examples of DLR which have been the brain-child of an individual teacher who spends his or her free time on the project.

The law on learning resources 2007 and the NCEM

214. A significant recent development is the new law (71/2007)²⁸ and related regulations (1268/2007) on learning resources. The law defines the responsibility and support of the government with regard to the development, preparation and publication of materials for pre-schools, compulsory schools and secondary schools as well as the procurement of materials for compulsory schools.
215. The new law has three main sections. The first concerns the NCEM which retains its role of providing materials for compulsory schooling. The NCEM should take the initiative on carrying

²⁷ <http://rasmus.is/Is.htm>

²⁸ Lög um námsgögn <http://www.althingi.is/lagas/nuna/2007071.html>

out surveys and research on the preparation and use of materials, and should keep abreast of developments pertinent to all school levels. Provision is however made for market competition and the NCEM is required to keep their legal role financially distinct from any initiatives it may take on the open market. The second main section covers the establishment of a fund for purchasing learning resources, the board of which will have the task of distributing funds to compulsory schools in order to meet the costs of purchasing materials on the open market.

216. Finally the law provides for the establishment of a fund for the development of new learning resources. A fund has existed for upper secondary school materials for several years, but this option is now being extended to other levels. The fund has the following role (Regulation 1268/2007):

The role of the development fund on learning resources is to promote innovation, development, production and publication of learning materials for preschools, compulsory schools and secondary schools, with the goal of ensuring a supply and variety of materials that are relevant to the needs of learners and schools.

217. The role of digital learning resources is not mentioned anywhere in the new law. The first grants were issued in June 2008.²⁹ In all 66 projects of 131 applications received grants to the value of 56,3 m.kr. About one fifth are digital but many of these are for secondary schools.

Summary and implications

218. Iceland has taken part in the European project called *Education and Training 2010* and one of the five Icelandic work groups addressed the issue of IT in education. Several challenges were identified in 2006 by the IT work group including a clear statement on DLR (Ministry of Education, Science and Culture, 2006/2007):

There is a need to guarantee a diverse and good supply of learning resources which use the technical possibilities available at any time, such as videos, slides with sound, visualisation, movement, film clips, transmissions and more. Here one can also mention multimedia and new versions of technology such as phones, which can be used for support in learning and teaching. There is a need to strengthen research on new approaches to developing learning resources and on innovative ways to present materials.

219. This review of the development of DLR in the Icelandic educational system indicates that as yet the challenge of producing DLR and using them has not yet been met. Many individuals make their contributions but only the NCEM and perhaps the School Web (see the case studies) come near to providing access to Icelandic DLR that uses technical possibilities currently available.

²⁹ <http://www.menntamalaraduneyti.is/frettir/Frettatilkynningar/nr/4596>

CHAPTER 5: CONCLUDING REMARKS

220. The purpose of this final chapter is to provide an overall assessment of the ICT policy in education, to comment on trends and changes particularly in the area of DLR, and to include a discussion of the vision for the future of policy in the field.
221. It has been argued elsewhere that there are three kinds of approach to the use of information and communication technology in education: optimistic-rhetoric, pessimistic-rhetoric and academic research (Reynolds, Treharne & Tripp, 2003). The optimists tend to believe that using ICT for learning will make a difference, that its properties and benefits (Newton & Rogers, 2003) are such that the development of ICT skills and access to digital learning resources (DLR) are a necessary part of educating for the future. Investments in ICT are inevitable. The results of such research generally focus on what has been achieved and are interpreted in a positive light. Then there are those who are pessimistic, who oppose using ICT in schools, who believe that using ICT distracts from the child's basic needs, particularly in the younger grades. Finally, there are those who carry out academic research (Reynolds *et al.*, 2003). One of the issues is whether children are learning about technology rather than with technology.
222. When looking at learning with ICT more closely then the Computer Practice Framework (CPF) developed by Twining (2002) is useful. He suggested that computers are used to develop IT skills, as a learning tool, and for other reasons, such as reward. The CPF considers the extent to which IT/computer use affects the content and practices of learning. He suggests that three categories can be distinguished when the computer is used as a tool for learning: *support* (same content, automated process but the task essentially unchanged), *extension* (different content and process in the task but neither requires a computer) and *transformation* (different content and process, both requiring a computer). While this background study of systemic innovation in Iceland will not address directly the issues raised by Twining, it might be useful to keep them in mind. Both the policies explored and the practices described in this report and in the case studies do not necessarily consider the notion of learning to be problematic nor the purpose to which ICT and DLR is put in schools.
223. In the two OECD/CERI projects on systemic innovation, on vocational education and training and on digital learning resources, systemic effects are being investigated. The broad aim of the DLR project is to review and evaluate the process of innovation involved in policies and public and private initiatives designed to promote the development, distribution and use of digital learning resources for the school sector. There is a danger that the underlying assumption is that using digital learning resources is 'a good thing' and that the difficulties and challenges being encountered may lie simply in the processes of innovation.

Commitment to a national system for production and use of DLR

224. The production and use of DLR was one short chapter in the key policy document *The power of information* (1996). It involved seven objectives:
1. Support for the development of Icelandic software.
 2. An assessment of what software is needed and of foreign software.
 3. The establishment of 'nuclear schools'.
 4. Increasing the knowledge of teachers and writers through courses.
 5. The development of teaching material to facilitate communication.
 6. The adaptation of resources to distance learning situations.
 7. The establishment of an Icelandic thesaurus.
225. For the first few years after *The power of information* a lot of work was done directly from the development division at the ministry, following up some of the objectives. Work was carried out on several fronts, both through larger centralised activities such as conferences, policy-making, managing the nuclear schools projects and preparing for a new upper secondary school based on the notion of distributed education and through smaller development grants to practitioners.

226. The NCEM was not given a direct mandate and although it received some extra funding for DLR work shortly after the publication of the national curriculum in 1999, DLR was not prioritised by the MESC nor really by the NCEM itself. Under the new law on learning materials funding to the NCEM will continue to be provided but it is also expected to compete with other individuals and organisations for project grants.
227. Innovation work in response to changes in society was being carried out independently, in schools and by individuals (for example, Cases B.4, B.5 and B.6), and several small companies were being started, such as the School Web (Case A.3), IceKids (Case B.6) and Mentor (discussed in paragraph 173).
228. The MESC minister who had initiated the early policy and activities was to another ministry in 2002. MESC priorities change with ministers and new challenges appear. In the last few years one of the major tasks being undertaken by MESC officials has been a major revision of laws on education, covering preschools, compulsory schools, secondary schools, universities and teacher education. The MESC has been restructured and the original staff of the development division has been relocated into other divisions, and responsibility for IT development is now distributed across several divisions.
229. The planned Educational Gateway (Case A.1) was just coming into being as policy priorities were changing. One part of the Gateway service is the practical supply of information about and for the school system. Another part was the linking of DLR to specific aims and objectives in the NC1999. This has not developed as envisaged.
230. Several universities and secondary schools have invested considerable time and effort in learning management systems for both on-campus learners and distance learners, but no particular directions seem to have been established with regard to DLR.
231. On 1st July 2008 the IUE merged with the University of Iceland, where it will form the mainstay of the School of Education. In a newly published policy on information technology in the university, little mention is made of distance learning. The general approach has been to simply tape lectures rather than work with DLR in learning management systems.

Weaknesses and strengths in ICT education policy, particularly in DLR

Weaknesses

232. The biggest weakness of ICT in education and DLR policy in Iceland is the smallness of the country and its administrative system.
233. The brief historical review offered in this report on developments in ICT and DLR in Iceland would indicate that Iceland sometimes falls short of sustainable commitment to DLR. Some of this could be attributed to the interests of individuals operating at policy-level at any one period. The presence or absence of a key official or politician in such a small system can make a difference when decisions are being made. Small departments in the ministry, for example, may change direction when staff retires or new appointments are made. There is not necessary any residual momentum which keeps development moving in a particular direction. This also means that some initiatives may be funded in their early stages but not followed up later as they give way to other emphases. This means that some innovations in Iceland do not run the full course of *identification-development-application-evaluation* or *conceptual development-construction-consolidation-further development/winding up* (OECD, 2007).
234. A related weakness is that evidence-based decision-making is not always feasible. This may in part be attributed to smaller organisations than in larger countries and the pressing need for staff to 'get on' with a range of other projects.
235. Another challenge of size to DLR and using ICT is not just smallness of numbers but also geography and the dispersed nature of about one-third of the population. This has meant that considerable effort has gone into learning management systems and ensuring access for all.
236. A final difficulty is the relative weakness of quality assessment when it comes to education. The laws on education require self-evaluation and the monitoring of whether self-evaluation is being

carried out, but does not easily provide for direct assessments of teaching and learning practice in schools.

Strengths

237. One of the strengths, ironically, is that having made a decision the smallness gives a certain flexibility in following it through, and that when a dedicated individual, unit or committee is already in place, change can occur quite quickly.
238. A second strength is the high level of education in the country and indeed a willingness to use and develop new technology, thus ICT and DLR policies, if realistic, can actually be implemented in quite a short time.

Threats and opportunities

239. The willingness to protect the Icelandic language and enrich its culture while a strength in itself also limits access to some avenues of development and cooperation with other countries. The uniqueness of the Icelandic language is constantly under threat as young people move through cyberspace and are competent at 'web-speak' versions of English. Interestingly though this very threat could be seen as an opportunity to make an international contribution through visual or graphic developments. The case of the game *Eve online* is a case in point, a company that has grown rapidly in recent years and employs a wide range of expertise to produce the game that has hundreds of thousands of dedicated players. This type of expertise, coupled with breaking educational research on modes of learning, could be an opportunity not to be missed.
240. The general approach in national and educational policy for the last 10-15 years has been to lay out strong national statements on using ICT and on the knowledge society and then basically to leave it to the free market to make these statements a reality. While in some cases this does indeed create opportunities, perhaps unseen, this hands-off approach at a national level also threatens an certain evenness of development and coordination that might provide a 'value added' effect. What might be a small risk in a larger system or economy becomes a sizeable risk in a small society.
241. A gap between school and private life in the use of ICT has been widening. Learners use ICT in a multitude of ways outside school but it is sometimes the case that schools have not adjusted to these new realities and still regard learner use outside school as a threat to education rather than an opportunity. Most older learners in school, at least from confirmation age (14 years), own their own laptop computers. Schools expect essays to be written using a word processor but often have not developed an overview of other learning opportunities concealed in the computers and with access to the internet. It should be noted however that the use of ICT has changed ways in which teachers prepare and present lessons.

A vision for the future

242. In the late 1980s a committee of four was appointed by the Ministry of Finance, the so-called RUT committee. In the first newsletter in 1989 one of the five topics discussed is the unlawful copying of software.³⁰ Ten years later in 1999 the tenth newsletter discussed a campaign to eradicate unlawful software from government institutions.³¹ The Information Society has taken the place of the RUT committee. Yet the newest national policy document has little to say about digital learning resources except that they should be developed.
243. Surely the vision for the future must include issues that address the opportunities presented by open source material, the changes in our society, culture and language, the effects of globalisation on learners of all ages and indeed, the very role of compulsory education in the 21st century. There must be though a discussion about rights and needs, of teachers and learners. ICT has a role to play in sustainable development. Can ways be found to develop and use digital learning resources for a better world? (a personal view).

³⁰ http://www.fjarmalaraduneyti.is/media/Frettabref_Vs_og_RUT-nefndar/dreifibr-rut-1.pdf

³¹ <http://www.fjarmalaraduneyti.is/utgefid-efni/frettabref/onnur-frettabref/RUT/nr/1150>

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APPENDIX 1

Time allocations to subjects in the national curriculum for compulsory schools

Subject areas in compulsory schools	Grades 1–4 (minutes /week)	Grades 5–7 (minutes /week)	Grades 8–10 (minutes /week)	Total teaching minutes / week
Language arts	960	600	600	2160
Mathematics	800	600	600	2000
Danish		120	440	560
English	40	240	400	680
Natural science and environmental studies	320	360	360	1040
Social studies and Christian moral and religious studies	480	440	280	1200
Music and art & design	640	480	160	1280
Home economics	160	240	80	480
Design and carpentry	160	120	40	320
Life skills	40	120	120	280
IT and technical subjects	160	120	40	320
Physical education	480	360	360	1200
School electives	560	400	960	1920
Total weekly minutes	4800	4200	4440	13440

APPENDIX II

Master's degrees related to ICT (list not exhaustive)

- Aðalbjörg María Ólafsdóttir (2007). Tæknin má ekki yfirtaka handverkið: Notkun tölvu- og upplýsingatækni í kennslu sex myndlistarkennara í grunnskólum. Master's dissertation, Iceland University of Education. [Using ICT in art].
- Anna Magnea Hreinsdóttir (2003). „Tóti var einn í tölvulandi, á tölvuspilið var snjall“. Athugun á tölvunotkun leikskólabarna. Master's dissertation, Iceland University of Education. [ICT use in pre-schools].
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- Ásrún Matthíasdóttir (1999). The division of early childhood education in the Icelandic University of Education: The attitudes of students and teachers. Master's dissertation, The Open University, United Kingdom.
- Ásthildur B. Jónsdóttir (2003). Listavefur krakka: Tölvu- og upplýsingatækni í myndlistarkennslu. M.Ed. project, Iceland University of Education. [Art education web].
- Brynhildur Anna Ragnarsdóttir (2002). Netnám og nemendasjálftæði. Master's dissertation, University of Iceland. [Student independence and web-learning].
- Eygló Björnsdóttir (2003). Á heimaslóð - námsefni í grenndarkennslu. M.Ed. project, Iceland University of Education. [Resources for teaching about the local community].
- Hilda Torfadóttir (2003). Lífsgleði njóttu! Lifandi lífsleiknivefur. Master's dissertation, Iceland University of Education. [Web for life-skills].
- Jón Jónasson (2001). Online distance education: a feasible choice in teacher education in Iceland? Master's dissertation, University of Strathclyde, Glasgow.
- Jóna Pálsdóttir (2005). Frá hugmynd að veruleika: rannsókn á fyrsta starfsári Fjölbrautaskóla Snæfellinga. Master's dissertation, University of Iceland. [The first year of the secondary school on Snæfellsness].
- Jóna Björg Sætran (2004). Fartölvur og tölvulæsi: Tölvur í kennslu og námi í framhaldskóla. Master's dissertation, Iceland University of Education. [Laptops and secondary school teaching].
- Kolbrún Svala Hjaltadóttir (2007). Hvernig gerum við tölvutækni að öflugu verkfæri í skólastarfi? Master's dissertation, Iceland University of Education. [ICT as a tool in schools].
- Kristín Guðmundsdóttir (2003). Námsstíll nokkurra fjarnemenda sem stunda nám á háskólastigi. Kennaraháskóli Íslands. Master's dissertation, Iceland University of Education. [Learning styles of distance education students]
- Kristín Björk Gunnarsdóttir (2004). Upplýsingatækni og ritun. M.Ed. project, Iceland University of Education. [ICT and writing].
- Kristín Runólfsson (2008). Tölvunotkun og -færni eldra fólks: Virk þátttaka í samfélaginu. . Master's dissertation, Iceland University of Education. [Computer skills of senior citizens].
- Lára Stefánsdóttir (2003). Fartölvur í námi og kennslu í Menntaskólanum á Akureyri 1999 - 2002. Master's dissertation, Iceland University of Education. [Laptops at the MA gymnasium].
- Manfred Lemke (2005). Færni íslenskra grunnskólakennara á sviði UST Niðurstöður greininga á árunum 2001 til 2002. Master's dissertation, Iceland University of Education. [ICT skills of teachers].
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- Sigríður Huld Konráðsdóttir (2007). Sofið á verðinum? tölvunotkun og tíðni netfíknar meðal nemenda í 6.-10. bekk á Íslandi. Master's dissertation, University of Iceland. [Computer use of computer addicts].
- Sylvía Guðmundsdóttir (1999). The use of computers in special needs teaching. Master's dissertation, Iceland University of Education.
- Þorsteinn Hjartarsson (2005). Skólastjórnun á upplýsingaöld. Master's dissertation, Iceland University of Education. [School leadership in the Information Age].
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