Chapter Four

School Practices and Conditions for Pedagogy and ICT

Willem PELGRUM

This chapter describes (1) the school conditions that potentially affect the teaching and learning practices of teachers and their use of ICT, and (2) changes in the use of lifelong-learning pedagogical practices in schools between 1998 and 2006, as perceived by school principals. The school conditions are described in terms of six conceptual domains included in the conceptual framework of SITES 2006 (see Chapter 2): vision, ICT-infrastructure, staff development, support, and organization of educational reform initiatives. Indicators for each of these domains are described in the sections that follow.

4.1 Introduction

Chapter 2, which described the conceptual framework for SITES 2006, showed that the issue of pedagogy and ICT can be investigated at different system levels: country, school, and teacher. This chapter focuses on the school level. Two main questions constituted the core of the school-level indicators in SITES 2006:

1. Are important conditions for implementing sustainable change present in schools? (This question is derived from Research Question 3; see Chapter 2.)

N. Law et al. (eds.), Pedagogy and ICT Use in Schools around the World, 67–120.

2. Have indicators of emerging pedagogical practices changed over time? (This question relates to Research Question 1; see Chapter 2).

Those readers interested in design issues regarding the school questionnaires (i.e., the questionnaires that were used, sample sizes, response rates, and "data-flagging" policies) should refer to Chapter 2. Readers should also be aware that the South African sample contained a substantial number of schools that did not have access to ICT (see section 4.2.2). Caution is therefore required when comparing the indicators for South Africa with those of the other education systems that participated in SITES 2006. Almost all schools in these systems had access to ICT.

4.2 Conditions at the school level

The indicators for the five domains listed above are described in the following sections.

4.2.1 Vision

An important lesson from earlier research (e.g., Fullan, 1993) is that sustainable development in relation to pedagogy and ICT requires educational actors at several levels of the education system to co-create a common vision of which goals need to be met in order to structure the school of the future. Quite often, as was shown in SITES-M2 (Kozma, 2003), ICT-related innovations in schools are launched by enthusiastic teachers who, as early adopters, initiate activities that usually start as marginal and, in their nature, extra-curricular. Such initiatives are in many cases not sustainable, as can be inferred from observations recorded during SITES-M2. The study showed, for example, that only 34% of the cases (selected because of their good reputations with regard to implementing ICT-related pedagogical innovations) showed evidence of sustainability. Moreover, sustainability of these initiatives was based on the presence of a supportive school environment, characterized by appropriate administrative support (from the school leadership), a sound infrastructure, and the existence of plans and policies (Owston, 2003).

At the school level, school leadership has an important role in stimulating the creation of a common vision for the school. In order to investigate the characteristics of school leaders with regard to their overall vision for the school and their developmental vision for pedagogy and ICT, I addressed the following questions:

1. What vision with regard to *pedagogy* in general, and to *ICT* in particular, do school leaders promote in their schools? Do these visions differ across education systems and can these differences be interpreted?
2. What measures do leaders take to promote a common vision?

Indicators of the extent to which school leaders (generally the school principals) promoted a particular vision of pedagogy were constructed from an item that asked the leaders to indicate to what extent they agreed or disagreed that the school leadership encouraged teachers to achieve each of 10 goals related to their (the teachers') pedagogical objectives. The results are summarized in Table 4.1, where the 10 goals are partitioned into three groups: lifelong learning, connectedness, and traditional. The indicators for each of these groups have reliabilities that varied from satisfactory to very high.

A first observation from Table 4.1 is that the extent of agreement with the statements about pedagogical vision generally is very high, with almost all means between 3 and 4. With regard to the first question posed at the beginning of this section, the following tentative answers can be given:

- School leaders in general claimed that they promoted visions with regard to traditional, lifelong learning and connectedness-related pedagogical goals. Connectedness attracted somewhat less support than the other two dimensions.
- Support for the three visions differed across education systems. Noteworthy are the relatively high scores on lifelong learning in Chile and Thailand versus the relatively low scores in Denmark, Finland, and Norway.

One of the 10 pedagogical vision items asked principals to indicate their degree of agreement with the statement that they encouraged their teachers to foster the development of "responsible internet behavior." Responses indicated that, in all 22 education systems, a majority of school leaders strongly agreed that they encouraged teachers to prepare students for responsible internet behavior. However, in a number of systems (in particular Israel, South Africa, and the Russian Federation), a substantial number of school leaders (20% or more) did not seem to pay attention to this issue.

Table 4.1 Vision of school leaders regarding pedagogy (mean (s.e.))

Education system	Vision lifelong learning	Vision connectedness	Vision traditional
[2,3] Alberta Province, Canada	3.35 (0.03)	3.05 (0.04)	3.70 (0.03)
Catalonia, Spain	3.44 (0.02)	3.27 (0.03)	3.48 (0.03)
[1] Chile	3.66 (0.02)	3.29 (0.03)	3.53 (0.02)
Chinese Taipei	3.45 (0.02)	3.25 (0.03)	3.38 (0.03)
[2] Finland	3.07 (0.02)	2.78 (0.03)	3.30 (0.03)
[2] Hong Kong SAR	3.29 (0.03)	3.07 (0.04)	3.28 (0.04)
[4] Israel	3.27 (0.03)	2.87 (0.05)	3.62 (0.03)
[1] Italy	3.55 (0.02)	3.29 (0.03)	3.30 (0.02)
[1] Japan	3.28 (0.02)	3.12 (0.02)	3.40 (0.02)
[2] Lithuania	3.47 (0.03)	3.08 (0.03)	3.31 (0.04)
Moscow, Russian Federation	3.47 (0.02)	3.07 (0.03)	3.61 (0.03)
[2] Ontario Province, Canada	3.44 (0.03)	3.00 (0.03)	3.56 (0.03)
Russian Federation	3.36 (0.02)	2.94 (0.03)	3.56 (0.02)
Singapore	3.52 (0.03)	3.23 (0.04)	3.31 (0.04)
Slovak Republic	3.33 (0.02)	3.10 (0.02)	3.28 (0.02)
Slovenia	3.30 (0.02)	3.01 (0.03)	3.30 (0.03)
South Africa	3.31 (0.03)	3.18 (0.03)	3.60 (0.02)
[1] Thailand	3.56 (0.03)	3.37 (0.03)	3.51 (0.03)
[#] Denmark	3.21 (0.03)	2.91 (0.04)	3.24 (0.04)
[#] Estonia	3.38 (0.03)	2.96 (0.04)	3.37 (0.04)
[#] France	3.44 (0.03)	3.09 (0.05)	3.49 (0.04)
[#] Norway	3.11 (0.03)	2.62 (0.05)	3.09 (0.04)

Notes:

Value labels for the response categories: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

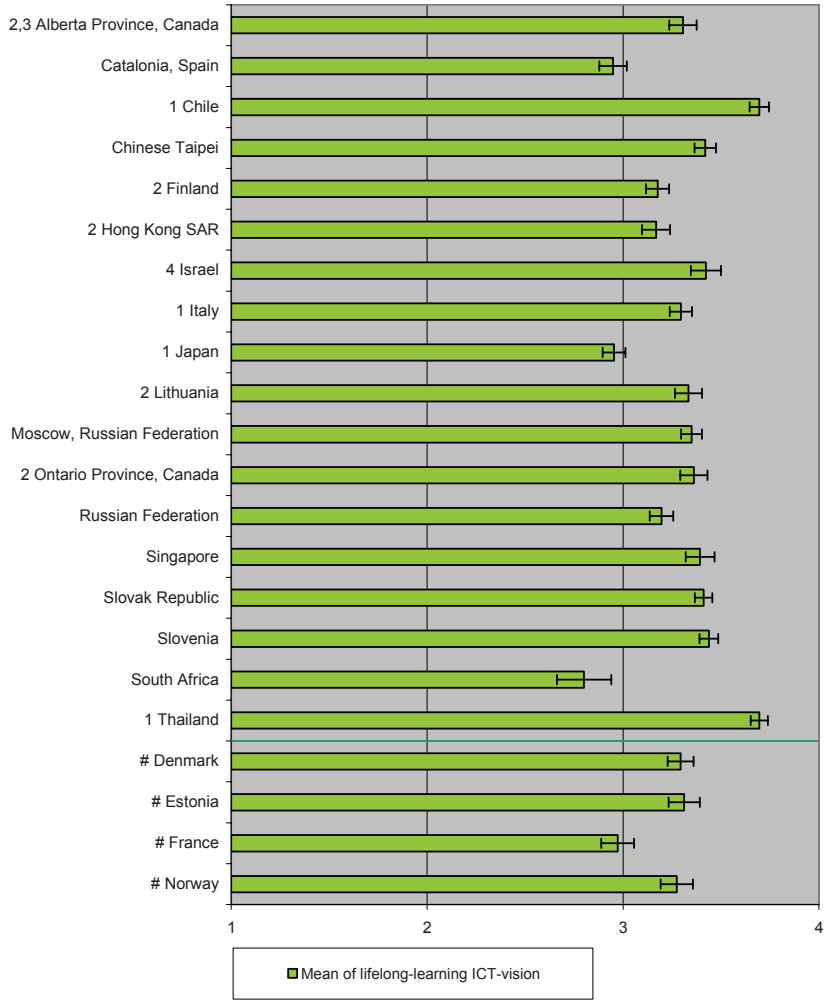
[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

Another item relating to ICT-vision asked school leaders to rate the importance of each of a list of 10 possible uses of ICT in their schools. Only one indicator could be constructed from this item—"lifelong-learning ICT-vision." The scale score (calculated as the mean score across these items) is shown in Figure 4.1. The figure shows that the lifelong-learning indicator was quite high in many systems, although there was variation across countries. Noteworthy are the relatively high scores of Chile and Thailand versus the relatively low scores of Catalonia, France, Japan, and South Africa. How to interpret these differences is not clear

Figure 4.1 Means and confidence intervals for an indicator of lifelong-learning ICT-vision



Notes:

Values for the response categories (importance) were 1=not at all, 2=a little, 3=somewhat, 4=a lot

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and will require further examination of national context information. The Thai NRC made the following observation (slightly edited):

> The National Education Act B.E. 2542 (1999) clearly identified the General Provisions for the development of the 21st skills driven by Technologies for Education (Chapter 9). Also, in the 9th National Economic and Social Development Plan (2007–2011), on the development of the quality of life of the Thai people in the knowledge-based society, ICT is qualified as crucial. Hence, school principals are aware of the importance of ICT.

Five of the 10 statements in this item were not included in the lifelong-learning indicator; the univariates for these are summarized in Table 4.2. From this table, one may infer that, in some systems (e.g., Chile, Thailand), a majority of school principals acknowledged the high importance of ICT for many different pedagogical aspects. However, in some other systems, this opinion was shared by only a minority of school leaders (for instance, those in Catalonia and Japan). Other observations, which call for more in-depth secondary analyses, can also be made from Table 4.2. These include the following:

- In Finland, only 5% of the school principals considered ICT very important for improving the performance of students, whereas in many other countries these percentages were much higher. This outcome may be related to the number of years that schools had been using ICT, but further analysis is necessary to confirm this supposition.
- ICT was recognized as a catalyst for change by a substantial number of school principals in some systems (e.g., Chile, Chinese Taipei, Israel, Lithuania, Slovenia, and Thailand), but this was not the case in other systems (Catalonia, Finland, Japan). When commenting on this observation, the Thai NRC said, "Thailand called for education reform in teaching and learning, student-centered and variety of assessment, so the school leaders encourage teachers to use alternative assessment."
- In some countries (Chile, Thailand), community expectations (by parents particularly) seemed to play an important role in decisions to use ICT but barely so in others (Catalonia, France, Hong Kong SAR).

Table 4.2 Percentages(s) of school leaders indicating that ICT-use is very important for achieving specified pedagogical objectives

Education system	Prepare for work	Improve performance	Exercise skills	Satisfy parents	Catalyst for change
[2,3] Alberta Province, Canada	39 (3.9)	28 (3.7)	30 (3.7)	14 (2.7)	21 (2.8)
Catalonia, Spain	12 (1.9)	14 (2.1)	29 (2.7)	10 (1.8)	11 (1.8)
[1] Chile	58 (2.3)	64 (2.4)	70 (2.5)	64 (2.3)	62 (2.6)
Chinese Taipei	42 (2.4)	26 (2.3)	38 (2.6)	28 (2.3)	47 (3.0)
[2] Finland	47 (3.4)	05 (1.5)	21 (2.5)	17 (2.5)	17 (2.4)
[2] Hong Kong SAR	26 (3.2)	11 (2.4)	16 (2.7)	09 (2.1)	23 (2.7)
[4] Israel	53 (3.2)	43 (2.9)	58 (3.4)	32 (3.1)	46 (2.9)
[1] Italy	29 (2.6)	15 (2.1)	34 (2.5)	24 (2.6)	24 (2.3)
[1] Japan	17 (2.0)	13 (1.9)	10 (1.7)	18 (2.0)	16 (1.8)
[2] Lithuania	33 (3.7)	27 (2.9)	29 (3.4)	39 (3.3)	49 (4.1)
Moscow, Russian Federation	45 (2.8)	34 (2.5)	42 (2.9)	34 (2.6)	42 (2.8)
[2] Ontario Province, Canada	41 (3.1)	26 (2.3)	33 (3.1)	15 (2.0)	24 (2.8)
Russian Federation	35 (2.8)	33 (2.6)	42 (2.8)	29 (2.7)	33 (2.5)
Singapore	44 (4.2)	19 (3.2)	31 (3.4)	14 (2.9)	44 (4.1)
Slovak Republic	55 (2.6)	33 (2.7)	49 (3.1)	36 (2.4)	40 (2.4)
Slovenia	50 (2.7)	29 (2.3)	53 (2.7)	24 (2.1)	60 (3.0)
South Africa	39 (2.5)	38 (2.7)	45 (2.9)	37 (2.7)	38 (2.6)
[1] Thailand	45 (3.0)	58 (2.9)	64 (3.0)	67 (2.8)	77 (2.6)
[#] Denmark	35 (3.5)	23 (3.0)	32 (3.1)	19 (2.6)	25 (2.8)
[#] Estonia	50 (4.0)	23 (3.2)	48 (3.4)	40 (3.5)	26 (3.1)
[#] France	17 (2.5)	29 (3.4)	24 (3.0)	10 (1.8)	24 (2.6)
[#] Norway	34 (3.8)	28 (3.7)	21 (3.3)	34 (3.9)	31 (3.5)

Notes:

Value labels for the response categories: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree

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4.2.2 Infrastructure (hardware and software)

Teachers cannot realize certain pedagogical goals unless information technology equipment and tools are available to them. They need not only sufficient equipment (PCs, printers, internet connections), but also ready access to software tools (for word-processing, communication, information retrieval) and communication facilities (e.g., email addresses for teachers and students). In addition, the location of equipment, ease of access, and maintenance of equipment are potentially important conditions facilitating the use of ICT for teaching and learning. Several questionnaire items related to infrastructure support were addressed to school officials; their responses are summarized in the four sub-sections that follow.

Access

Table 4.3 shows how many schools had ICT—including internet—that students in the target grade could access. The table also shows statistics for systems that participated in the 1998/1999 school year (SITES-M1).

- All but one education system where access was not universal in 1998 could provide students with full access by 2006. The exception was South Africa, despite its enormous leap forward over the eight-year period. The minor differences in the table between 1998 and 2006 of a few percentage points are not statistically meaningful and should not be interpreted as a decline in access.
- In almost all education systems, schools that had access to computers also had access to internet. The main exceptions were the Russian Federation and South Africa, where internet access was still relatively low. Quite substantial increases in access to internet took place in most education systems between 1998 and 2006, in particular in the Russian Federation and Thailand.

The results in Table 4.3 provide one view of access to ICT. However, more detail is needed to determine how much access students actually had to ICT-infrastructure. In Figure 4.2, the number of computers available in a school is expressed as a ratio of the number of students in the school to the number of available computers. This ratio is then expressed in terms of percentages of schools that fell within five categories (fewer than 5 students per computer, 5–9 students per computer, 10–19, 20–40, more than 40). Note that for notational convenience, ratios are reported as single numbers; for example, 5 instead of 5–1.

Table 4.3 Percentages (standard errors) of schools in 1998 and 2006 able to provide Grade 8 students with access to computers and percentages of these schools with access to internet

Education system	Percentage of schools with computers for Grade 8 students (2006)	Percentage of students at schools using ICT for instructional purposes (1998)*	Internet (2006)	Internet (1998*)
[2,3] Alberta Province, Canada	100 (0.0)	-	100 (0.0)	-
Catalonia, Spain	99 (0.5)	-	99 (0.5)	-
[1] Chile	96 (1.0)	-	92 (1.3)	-
Chinese Taipei	100 (0.0)	100	99 (0.7)	62
[2] Finland	100 (0.0)	100	100 (0.0)	96
[2] Hong Kong SAR	98 (0.9)	100	100 (0.5)	80
[4] Israel	96 (1.3)	85	98 (0.8)	53
[1] Italy	99 (0.6)	79	99 (0.4)	73
[1] Japan	99 (0.4)	100	100 (0.3)	58
[2] Lithuania	99 (0.6)	77	100 (0.0)	56
Moscow, Russian Federation	98 (0.7)	-	97 (1.0)	-
[2] Ontario Province, Canada	98 (0.8)	-	99 (0.9)	-
Russian Federation	95 (1.5)	53	49 (3.0)	4
Singapore	100 (0.0)	100	100 (0.0)	100
Slovak Republic	100 (0.4)	-	99 (0.5)	-
Slovenia	99 (0.5)	100	100 (0.0)	85
South Africa	38 (2.3)	18	67 (4.0)	52
[1] Thailand	96 (1.3)	50	97 (1.0)	25
[#] Denmark	99 (0.9)	100	100 (0.0)	85
[#] Estonia	100 (0.0)	-	100 (0.0)	-
[#] France	96 (1.6)	100	98 (1.0)	55
[#] Norway	100 (0.4)	100	100 (0.0)	81

Notes :

* Pelgrum & Anderson (2001); no standard errors provided

- Data not collected

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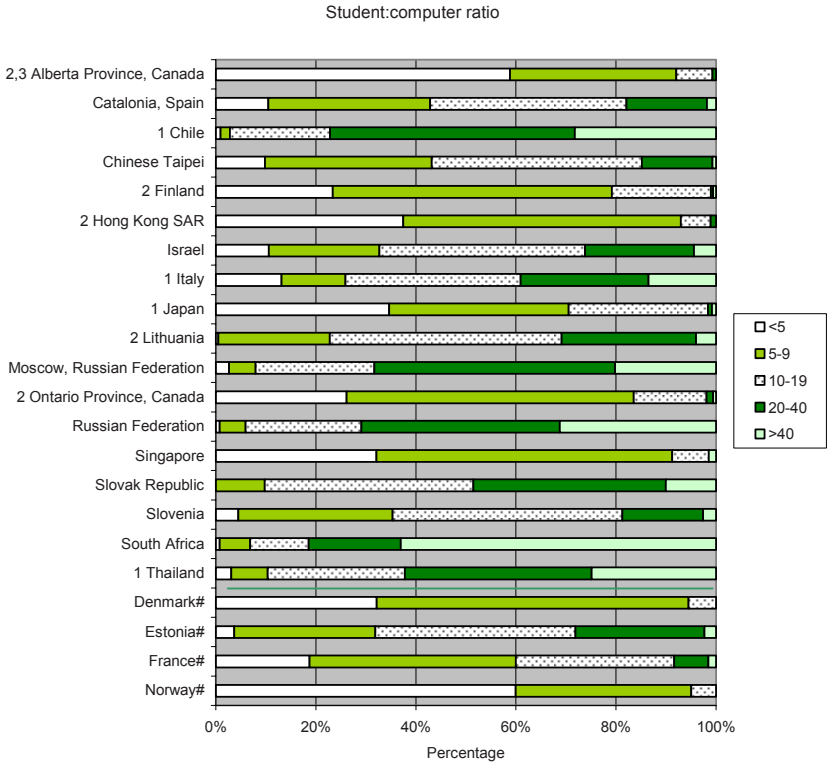
Figure 4.2 shows huge differences between education systems in terms of ICT-infrastructural conditions. In some systems, the student–computer ratios were very favorable (fewer than 5) in more than half the schools (e.g., Alberta Province and Norway) or favorable (fewer than 10) (Denmark, Finland, France, Japan, Hong Kong, Ontario, and Singapore). In other systems (in particular, as expected, the developing economies), a favorable ratio had yet to be reached, and in quite a number of systems (Italy, Russian Federation, Slovak Republic, South Africa, and Thailand),

hardly any schools had ratios under 10. Huge differences were also apparent within systems, a finding that points to the existence of serious inequities between schools in terms of possibilities for their students to access computers, and one likely to be an important issue for policymakers to consider in forthcoming years.

Figure 4.2 Percentages of schools falling within five student–computer ratio categories



Notes:
*Figure relates only to schools possessing computers
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Although Table 4.3 showed that almost all schools in the majority of education systems had access to the internet, this does not necessarily

imply that students had *sufficient* access to it. Possibilities for students' access depend on the number of computers in schools that are connected to the internet. Examining the extent to which this was the case required calculation of a so-called student–internet–computer ratio. This ratio was based on the answers of the school technology coordinators to a question asking how many computers in the school were connected to the internet. The resulting indicator (i.e., the number of students in the school divided by the number of computers connected to the internet) showed that most of the computers available in the schools were connected to the internet. Thus, the observations made on the basis of the observed student–computer ratio in Figure 4.2 also held for the student–internet-computer ratio (see Table w4.1 at http://www.sites2006.net/appendix).

The comparison of the access-related information for 1998 and for 2006 showed some significant differences (see Table W4.2 at http://www.sites2006.net/appendix). For example:

- The number of computers in schools increased substantially across the eight-year period in Chinese Taipei, Denmark, Finland, Hong Kong, Japan, Norway, Singapore, and Slovenia;
- In South Africa, more schools had ratios greater than 40 by 2006, but this finding should be seen against the fact that the number of schools possessing any computers increased dramatically from 1998 on.

Computers are not the only ICT-related instruments available in schools. Others, including laptops, PDAs, smart boards, and digital projectors (sometimes called "beamers"), are also used in many jurisdictions. On the basis of earlier assessments, the SITES researchers hypothesized that there would be little evidence of these recently developed devices in schools, but that the availability of these tools would increase in forthcoming years.

For that reason, the SITES researchers deemed it important to report baseline data on the extent to which these tools were available in schools in 2006. The team also considered it important to investigate the availability of graphic calculators, which are generally used in a similar way to particular computer software (e.g., spreadsheets for calculations and programming). A first analysis showed the average number of such devices was close to zero in most systems, except in Hong Kong and Singapore, where, for example, the number of beamers in schools was relatively high (on average respectively 33 and 61 per school).

The distribution of beamers in all systems is shown in Table 4.4 (see Table W4.3 at http://www.sites2006.net/appendix), which contains the distributions for the other devices). Here we can see that the majority of schools in most education systems possessed beamers, but generally no more than five, indicating that this equipment was not yet a standard part of the infrastructure in most classrooms around the world at the time of SITES 2006. Further analyses are needed to determine how much the presence of these devices in classrooms were contributing to the use of particular pedagogical practices in schools (e.g., whole-class teaching).

In the future, it is reasonable to expect that students increasingly will bring their own equipment to schools. As a benchmark for examining these developments, technology coordinators were asked to estimate what percentage of students brought their own PDA, graphic calculator, or laptop to school. In most education systems (see Table W4.4 at http://www.sites2006.net/appendix) in almost all schools, the percentages were below 10%. However, there were some education systems where a sizeable number of schools indicated that students brought their own equipment. For example, more than 10% of the students in about 25% of the Norwegian schools brought their own laptops to school and more than 10% of the students brought their own graphic calculators in a substantial number of schools in Canada-Alberta, Catalonia, Denmark, and France. More than 20% of the students in Moscow brought their own PDAs.

The availability of equipment is one access-related consideration with regard to school ICT-infrastructure. Also important is the question of what tools and facilities teachers and students have available to them to support their teaching and learning activities and what the needs of the schools are with regard to equipment. Table 4.5, which summarizes the data on the availability of a variety of technology applications in the schools, shows that, across the education systems, the following types of applications were available:

- Equipment and hands-on materials (e.g., laboratory equipment, musical instruments, art materials, overhead projectors, slide projectors, electronic calculators)
- Tutorial/exercise software
- General Office suite (e.g., word-processing, database, spreadsheet, presentation software), and

- Multimedia production tools (e.g., media-capture and editing equipment, drawing programs, webpage/multimedia production tools).

Table 4.4 Percentages (standard errors) of schools that possessed a certain quantity of projectors ("beamers") for presentation of digital materials

Education system	0	1	2-5	>5
[2,3] Alberta Province, Canada	4 (1.8)	22 (3.6)	55 (4.6)	19 (2.9)
Catalonia, Spain	7 (1.8)	30 (2.5)	51 (2.4)	11 (1.6)
[1] Chile	42 (2.0)	44 (2.2)	13 (1.3)	1 (0.5)
Chinese Taipei	0 (0.2)	6 (1.4)	51 (2.4)	43 (2.1)
[2] Finland	3 (1.2)	18 (2.0)	59 (2.8)	19 (2.3)
[2] Hong Kong SAR	4 (1.1)	0 (0.0)	2 (0.8)	94 (1.4)
[4] Israel	18 (2.4)	48 (2.8)	32 (2.5)	2 (0.6)
[1] Italy	8 (1.3)	48 (3.0)	43 (2.9)	2 (0.8)
[1] Japan	9 (1.5)	27 (2.1)	57 (2.6)	7 (1.2)
[2] Lithuania	24 (3.1)	34 (3.4)	38 (3.0)	3 (0.9)
Moscow, Russian Federation	18 (2.1)	30 (2.8)	44 (2.4)	8 (1.6)
[2] Ontario Province, Canada	7 (1.8)	51 (3.4)	39 (3.3)	3 (0.9)
Russian Federation	66 (3.0)	25 (2.6)	9 (1.7)	0 (0.1)
Singapore	0 (0.0)	0 (0.0)	0 (0.0)	100 (0.0)
Slovak Republic	36 (2.2)	49 (2.7)	16 (1.6)	0 (0.0)
Slovenia	1 (0.6)	30 (2.3)	66 (2.5)	3 (1.0)
South Africa	79 (1.6)	13 (1.4)	7 (1.0)	2 (0.7)
[1] Thailand	79 (1.5)	13 (1.5)	6 (0.8)	3 (0.5)
[#] Denmark	1 (0.7)	24 (3.2)	66 (3.4)	10 (2.0)
[#] Estonia	10 (2.4)	43 (3.2)	38 (3.8)	9 (2.2)
[#] France	11 (2.8)	23 (2.7)	56 (3.5)	9 (1.7)
[#] Norway	3 (1.4)	16 (3.2)	69 (3.7)	12 (2.4)

Notes :

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Table 4.5 presents a highly variegated picture, but some relatively general trends can be noted.

- ICT-equipment (e.g., laboratory equipment, musical instruments, art materials, overhead projectors, slide projectors, and calculators) was available in more than 75% of the schools. The exceptions were

Chile (47% of schools), Estonia (66%), Israel (70%), Lithuania (72%), Moscow (65%), the Russian Federation (47%), South Africa (17%), and Thailand (40%).

- Tutorial software was available in more than 75% of the schools in Denmark, France, Norway, Ontario, Singapore, and Slovenia. The availability of tutorial software was very low in South Africa (10%) and Thailand (17%).
- General-purpose software (e.g., word-processing, database, spreadsheet, and presentation) was available in most schools in most countries, with the exception of South Africa and Thailand.
- A minority of schools possessed learning management software, such as web-based learning environments. Exceptions were Hong Kong (91% of schools), Norway (70%), and Singapore (95%).
- Mobile devices were evident in very few schools.
- In most education systems, smart boards (interactive white boards) were available in only 20% or less of the schools. The availability was higher in Alberta (47%), Denmark (25%), Hong Kong (26%), Lithuania (32%), Moscow (21%), and Singapore (28%).
- The availability of email accounts was higher in all education systems for teachers than for students (in particular in Alberta, Catalonia, Finland, Italy, Norway, Ontario, and Singapore). The differences between education systems were large. For example, whereas in Alberta, Chinese Taipei, Denmark, Estonia, Finland, Hong Kong, Norway, Ontario, Singapore, and Slovenia, almost all schools had email accounts for their teachers, this was the case in only 18% of the schools in the Russian Federation, 13% of the schools in South Africa, and 11% of the schools in Thailand. Nevertheless, most schools (except South Africa, the Russian Federation and Thailand) possessed communication software.

Needs

While policymakers may be interested in the extent to which equipment is available, they certainly want answers to questions such as "Is the number of PCs available in schools sufficient?", "Is the available bandwidth for internet use appropriate for realizing the pedagogical goals of schools?", and "Are there sufficient digital learning resources available in schools?" SITES 2006 provided some data related to these questions through one of the questions asked of technology coordinators. This question asked the coordinators to state which of the resource

Table 4.5 Percentages (standard errors) of schools in which common types of technology applications and facilities were ***available***

Education system	Equipment	Tutorial software	General software	Multimedia production	Data-logging	Simulation	Communi-cation software	Digital resources	Mobile devices	Smart board	LMS	Mail accounts (teachers)	Mail accounts (students)
[2,3] Alberta Province, Canada	88 (3.0)	68 (4.0)	100 (0.0)	81 (3.1)	44 (3.6)	43 (4.0)	76 (3.5)	87 (3.1)	22 (3.4)	47 (4.1)	48 (4.1)	95 (1.5)	53 (4.3)
Catalonia, Spain	88 (1.6)	57 (2.7)	99 (0.7)	84 (2.3)	73 (2.8)	59 (3.0)	89 (1.9)	87 (1.7)	21 (2.1)	07 (1.6)	44 (2.9)	88 (1.9)	49 (2.7)
[1] Chile	47 (1.8)	45 (2.2)	90 (1.3)	54 (2.4)	63 (2.1)	48 (2.2)	79 (1.8)	72 (1.9)	13 (1.5)	06 (1.3)	39 (2.4)	68 (2.0)	52 (2.2)
Chinese Taipei	96 (1.1)	48 (2.5)	99 (0.4)	89 (1.6)	54 (2.5)	21 (2.1)	93 (1.3)	74 (2.5)	10 (1.7)	07 (1.3)	42 (2.8)	95 (1.2)	74 (2.2)
[2] Finland	96 (1.2)	66 (2.8)	99 (0.7)	77 (2.6)	64 (3.2)	20 (2.4)	92 (1.7)	78 (2.6)	11 (2.1)	10 (1.8)	46 (2.7)	97 (1.1)	59 (2.8)
[2] Hong Kong SAR	97 (1.1)	72 (3.0)	100 (0.0)	97 (1.0)	77 (2.7)	47 (3.0)	98 (0.8)	89 (2.0)	20 (2.7)	26 (2.7)	91 (1.8)	98 (1.0)	88 (2.0)
[4] Israel	70 (2.9)	46 (3.3)	96 (1.3)	44 (3.1)	55 (3.6)	16 (2.1)	84 (2.5)	53 (3.1)	13 (1.7)	08 (1.5)	46 (3.0)	54 (3.1)	40 (3.1)
[1] Italy	85 (2.1)	60 (3.2)	99 (0.6)	63 (2.9)	70 (2.6)	37 (2.8)	73 (2.8)	60 (3.1)	11 (2.0)	11 (1.6)	19 (2.2)	64 (2.7)	14 (2.0)
[1] Japan	94 (1.2)	58 (2.5)	97 (0.7)	76 (2.4)	22 (2.1)	39 (2.2)	62 (2.5)	51 (2.4)	03 (0.8)	20 (2.2)	35 (2.4)	56 (2.2)	22 (2.1)
[2] Lithuania	72 (3.1)	74 (2.9)	90 (2.1)	70 (2.9)	70 (3.4)	37 (3.8)	94 (1.5)	87 (2.4)	38 (3.2)	32 (2.9)	19 (2.6)	62 (3.5)	58 (3.6)
Moscow, Russian Federation	65 (2.6)	65 (2.4)	81 (2.1)	47 (2.9)	24 (2.4)	24 (2.4)	81 (2.0)	55 (2.6)	26 (2.3)	21 (1.9)	09 (1.4)	53 (2.5)	38 (2.3)
[2] Ontario Province, Canada	81 (2.5)	78 (2.7)	99 (0.5)	83 (2.4)	75 (3.0)	59 (3.4)	64 (3.2)	90 (1.9)	09 (2.0)	21 (2.3)	54 (3.0)	100 (0.2)	32 (3.1)
Russian Federation	47 (3.9)	61 (3.2)	73 (3.5)	34 (2.7)	10 (1.8)	27 (3.2)	36 (2.7)	49 (3.9)	15 (2.1)	02 (0.5)	05 (1.2)	18 (2.3)	13 (2.1)
Singapore	98 (1.1)	85 (2.9)	100 (0.0)	93 (2.1)	95 (1.8)	66 (4.2)	98 (1.2)	92 (2.2)	34 (3.5)	28 (3.4)	95 (1.8)	100 (0.0)	58 (3.9)
Slovak Republic	75 (2.3)	48 (2.8)	97 (0.9)	68 (2.6)	25 (2.3)	40 (2.9)	97 (1.0)	83 (2.0)	21 (2.0)	17 (2.3)	25 (2.6)	81 (2.0)	72 (2.7)
Slovenia	92 (1.4)	87 (2.0)	100 (0.3)	80 (2.1)	93 (1.3)	55 (2.6)	98 (0.7)	78 (2.1)	21 (2.3)	04 (1.0)	48 (2.5)	97 (1.0)	91 (1.5)
South Africa	17 (1.4)	10 (1.4)	35 (2.2)	07 (1.0)	11 (1.6)	04 (0.8)	14 (1.4)	20 (2.0)	13 (1.8)	09 (1.0)	07 (1.3)	13 (1.4)	08 (1.4)
[1] Thailand	40 (2.4)	17 (2.0)	51 (2.8)	22 (1.9)	04 (1.0)	06 (1.2)	44 (2.4)	49 (2.7)	05 (1.1)	06 (1.2)	13 (1.8)	11 (1.5)	10 (1.3)
[#] Denmark	94 (2.0)	93 (1.9)	99 (1.0)	89 (2.4)	44 (3.7)	53 (3.9)	97 (1.2)	93 (2.0)	11 (2.3)	25 (3.2)	51 (3.7)	96 (1.4)	89 (2.3)
[#] Estonia	66 (3.8)	64 (3.6)	98 (1.1)	57 (4.1)	35 (3.4)	21 (3.4)	93 (2.0)	67 (3.8)	22 (3.2)	21 (2.8)	21 (3.4)	94 (1.8)	57 (4.2)
[#] France	86 (2.5)	80 (3.5)	99 (1.0)	68 (3.3)	76 (3.5)	50 (3.6)	71 (3.3)	83 (2.6)	18 (2.7)	14 (2.6)	26 (3.5)	78 (2.8)	48 (3.7)
[#] Norway	92 (2.4)	88 (2.5)	100 (0.0)	78 (3.2)	28 (3.3)	34 (3.9)	95 (1.3)	83 (3.1)	13 (2.7)	07 (1.8)	70 (4.0)	89 (2.6)	54 (4.5)

Notes :

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

materials not available in their schools they would like to have available. These data are presented in Table 4.6. The results in Table 4.6 seem to complement those in Table 4.5 in that "not available" can be translated into "needed." This is a plausible and non-tautological conclusion because respondents could also have responded with "not available and not needed." Further analysis confirmed the existence of this complementary character for smart boards and email accounts for students, but also revealed that it was not fully the case. For example, smart boards were available in only 10% of Finnish schools, but perceived as needed by 46%. Email accounts for students were available in roughly 20% of Japanese schools but perceived as needed in only 19%. Explanations for these responses will require further analyses. In regard to the Japanese email accounts, the NRC for Japan said, "almost all of the Japanese students have their own email account outside school. They have at least one email account in their mobile phone and communicate with their friends very frequently. There are also some cases where schools use the mobile phone's emailing system for communication between school and family."

Another finding based on Table 4.6 data is that, in some systems, schools said they needed many of the listed technology applications. These systems included Chile, South Africa, and Thailand. Also, across systems, it appears that smart boards and learning management systems (LMSs) were seen as needed. In Hong Kong and Singapore, the availability of LMSs seemed sufficient, as only a small percentage of schools (9% and 5% respectively) expressed a need for these tools.

While the questionnaire item that was the data source for Table 4.6 listed equipment and resources to be ticked, the data for another item addressed to school managers throws more light on the highest priorities of schools. Principals were asked to indicate how much priority they attached to resource allocation in several areas, as shown in Box 4.1.

Table 4.7 shows the percentages of principals rating these options as high priority. Quite a scattered picture is revealed in the data, in that sizeable numbers of schools across the education systems had high priorities in most areas. The data also show that the systems had highly individualistic response patterns to these areas of perceived need.

Table 4.6 Percentages (standard errors) of technology coordinators indicating that common types of technology applications and facilities were ***not available but needed***

Education system	Equipment	Tutorial software	General software	Multimedia production	Data-logging	Simulation	Communi-cation software	Digital resources	Mobile devices	Smart board	LMS	Mail accounts (teachers)	Mail accounts (students)
[2,3] Alberta Province, Canada	11 (2.9)	27 (4.1)	0 (0.0)	17 (2.9)	34 (3.9)	42 (3.9)	10 (2.5)	12 (3.0)	15 (2.4)	41 (4.4)	31 (3.9)	5 (1.5)	21 (3.4)
Catalonia, Spain	12 (1.6)	34 (2.6)	1 (0.5)	14 (2.1)	16 (2.5)	31 (2.7)	8 (1.8)	10 (1.7)	38 (2.7)	62 (3.1)	45 (2.8)	8 (1.4)	29 (2.6)
[1] Chile	51 (1.8)	54 (2.2)	9 (1.2)	43 (2.4)	32 (2.1)	49 (2.2)	19 (1.8)	26 (1.9)	57 (2.6)	83 (1.9)	57 (2.4)	27 (2.2)	39 (2.3)
Chinese Taipei	3 (1.0)	45 (2.4)	1 (0.4)	11 (1.6)	35 (2.3)	66 (2.3)	5 (1.2)	25 (2.4)	48 (2.6)	68 (2.6)	54 (2.8)	5 (1.2)	15 (1.9)
[2] Finland	4 (1.2)	31 (2.9)	0 (0.2)	21 (2.4)	22 (2.8)	61 (3.2)	5 (1.4)	20 (2.5)	26 (2.4)	46 (3.6)	38 (2.8)	2 (1.1)	24 (2.6)
[2] Hong Kong SAR	3 (1.0)	23 (2.9)	0 (0.0)	3 (1.0)	13 (2.0)	39 (2.8)	1 (0.7)	9 (1.8)	45 (3.1)	47 (3.1)	9 (1.7)	1 (0.5)	6 (1.3)
[4] Israel	23 (2.8)	39 (2.9)	3 (1.0)	43 (3.3)	29 (3.2)	44 (3.4)	11 (2.0)	36 (3.1)	34 (3.2)	55 (3.4)	42 (2.9)	27 (3.0)	30 (2.8)
[1] Italy	15 (2.1)	36 (2.9)	1 (0.6)	33 (2.7)	22 (2.3)	47 (2.7)	21 (2.6)	36 (2.9)	35 (2.8)	68 (2.5)	61 (2.7)	29 (2.5)	42 (2.5)
[1] Japan	4 (1.1)	24 (2.3)	3 (0.7)	18 (2.1)	36 (2.4)	35 (2.6)	19 (2.0)	31 (2.3)	17 (2.0)	41 (2.5)	26 (2.3)	25 (2.0)	19 (2.1)
[2] Lithuania	27 (3.1)	25 (2.8)	8 (2.0)	27 (3.1)	24 (3.1)	56 (3.5)	5 (1.5)	13 (2.4)	35 (3.2)	64 (3.2)	75 (2.9)	31 (3.0)	29 (2.9)
Moscow, Russian Federation	34 (2.6)	34 (2.4)	18 (2.0)	52 (2.8)	67 (2.5)	74 (2.4)	18 (1.9)	44 (2.6)	59 (2.6)	73 (2.2)	79 (2.0)	42 (2.6)	43 (2.7)
[2] Ontario Province, Canada	18 (2.4)	18 (2.6)	1 (0.5)	14 (2.2)	14 (2.4)	33 (3.2)	13 (2.3)	9 (1.8)	21 (2.5)	53 (3.1)	29 (2.9)	0 (0.2)	20 (2.7)
Russian Federation	52 (3.9)	39 (3.5)	26 (3.6)	63 (2.9)	78 (3.1)	68 (3.0)	63 (2.8)	51 (4.1)	64 (3.1)	92 (1.6)	83 (2.5)	75 (2.6)	74 (2.6)
Singapore	2 (1.1)	10 (2.5)	0 (0.0)	6 (1.9)	2 (1.2)	24 (3.6)	2 (1.2)	6 (1.9)	22 (3.5)	32 (3.9)	5 (1.8)	0 (0.0)	19 (3.0)
Slovak Republic	25 (2.2)	39 (2.4)	2 (0.7)	27 (2.4)	45 (2.9)	51 (3.0)	2 (0.9)	17 (2.0)	41 (2.8)	67 (2.9)	57 (2.8)	12 (1.7)	12 (1.7)
Slovenia	8 (1.4)	13 (2.0)	0 (0.3)	20 (2.1)	7 (1.2)	35 (2.4)	1 (0.6)	22 (2.1)	49 (2.7)	63 (2.8)	45 (2.7)	2 (0.9)	5 (1.2)
South Africa	83 (1.4)	88 (1.5)	54 (2.2)	91 (1.2)	86 (1.7)	93 (1.1)	83 (1.6)	80 (2.0)	79 (2.1)	88 (1.2)	89 (1.3)	83 (1.7)	84 (1.8)
[1] Thailand	59 (2.4)	83 (1.9)	49 (2.8)	78 (1.9)	93 (1.3)	93 (1.4)	56 (2.4)	51 (2.7)	92 (1.5)	91 (1.5)	86 (1.9)	86 (1.7)	87 (1.6)
[#] Denmark	4 (1.5)	5 (1.8)	1 (0.7)	9 (2.1)	39 (3.6)	35 (3.1)	0 (0.0)	6 (1.9)	34 (3.7)	62 (3.7)	38 (3.8)	2 (1.0)	6 (1.7)
[#] Estonia	33 (3.8)	36 (3.6)	2 (1.1)	41 (4.2)	48 (3.9)	74 (3.6)	6 (1.8)	32 (3.7)	38 (3.9)	71 (3.3)	72 (3.5)	4 (1.5)	17 (2.9)
[#] France	14 (2.5)	18 (3.9)	0 (0.0)	26 (3.2)	19 (3.1)	40 (3.7)	14 (2.4)	15 (2.7)	43 (3.8)	70 (3.6)	60 (3.5)	17 (2.6)	31 (3.7)
[#] Norway	8 (2.4)	11 (2.4)	0 (0.0)	22 (3.2)	56 (3.7)	57 (3.8)	4 (1.0)	16 (2.9)	26 (3.4)	59 (3.4)	25 (3.7)	9 (2.7)	31 (4.1)

Notes:

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

Table 4.7 Percentages (standard errors) of school principals giving high priority to a number of infrastructure-related issues

Education system	Decrease student-computer ratio	More computers on internet	Increase bandwith	Increase range digital resources	Online support platform
[2,3] Alberta Province, Canada	28 (3.6)	42 (3.6)	33 (3.1)	29 (3.7)	20 (2.8)
Catalonia, Spain	51 (2.4)	71 (2.5)	55 (2.9)	46 (2.9)	25 (2.3)
[1] Chile	63 (2.3)	84 (1.8)	75 (1.9)	83 (1.8)	56 (2.6)
Chinese Taipei	46 (2.7)	53 (2.7)	64 (2.6)	53 (2.8)	55 (2.8)
[2] Finland	21 (2.8)	29 (2.7)	16 (2.4)	17 (2.7)	18 (2.7)
[2] Hong Kong SAR	24 (3.0)	39 (3.5)	40 (3.7)	30 (3.2)	49 (3.9)
[4] Israel	62 (2.9)	75 (2.6)	55 (2.9)	51 (3.4)	34 (3.3)
[1] Italy	39 (3.1)	49 (3.0)	36 (2.8)	35 (2.6)	22 (2.5)
[1] Japan	36 (2.4)	35 (2.3)	28 (2.1)	11 (1.4)	14 (1.8)
[2] Lithuania	55 (3.3)	66 (3.3)	46 (3.6)	40 (3.5)	26 (3.0)
Moscow, Russian Federation	47 (2.9)	55 (2.6)	42 (2.5)	51 (2.6)	25 (2.5)
[2] Ontario Province, Canada	40 (2.8)	49 (3.0)	23 (2.7)	32 (2.7)	14 (2.0)
Russian Federation	30 (3.2)	27 (2.6)	24 (2.2)	26 (2.9)	11 (1.8)
Singapore	22 (3.6)	50 (4.1)	50 (4.1)	63 (4.2)	79 (3.8)
Slovak Republic	52 (2.6)	67 (2.5)	57 (2.8)	41 (2.6)	24 (2.5)
Slovenia	25 (2.5)	60 (2.7)	32 (2.2)	26 (2.4)	13 (2.0)
South Africa	40 (2.5)	49 (2.5)	40 (2.5)	43 (2.5)	40 (2.4)
[1] Thailand	60 (2.9)	84 (2.1)	76 (2.6)	65 (2.7)	59 (2.9)
[#] Denmark	37 (3.9)	72 (3.8)	45 (3.4)	24 (3.1)	28 (2.9)
[#] Estonia	23 (3.2)	43 (3.6)	32 (3.5)	35 (3.3)	30 (3.4)
[#] France	45 (3.5)	52 (3.7)	34 (3.6)	41 (3.4)	16 (2.5)
[#] Norway	57 (4.2)	62 (3.9)	45 (4.0)	41 (3.7)	52 (4.5)

Notes:

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

Box 4.1 Question to school principals about resource priorities

Question:
What priority level do you give to resource allocation in your school in order to enhance the use of ICT in teaching and learning for the Grade 8 students in your school? (answer options: not a priority, low priority, medium priority, high priority)

1. To decrease the number of students per computer
2. To increase the number of computers connected to internet
3. To increase the bandwidth for internet access of the computers connected to internet
4. To increase the range of digital learning resources related to the school curriculum
5. To establish/enhance an online learning support platform and its management so that teaching and learning can take place any time, anywhere

Another perspective regarding the sufficiency of equipment and tools available can be gained from considering the obstacles that schools saw as seriously hindering their capacity to realize their pedagogical goals. School principals as well as technology coordinators were asked to report the extent to which they thought the following infrastructure-related obstacles were hindering realization of their respective school's pedagogical goals: (a) insufficient number of computers connected to the internet; (b) lack of special ICT-equipment for disabled students; (c) insufficient ICT-equipment for instruction; (d) computers out of date; (e) not enough digital educational resources for instruction; (f) lack of ICT-tools for science laboratory work; and (g) insufficient budget for non-ICT-supplies (e.g., paper, pencils).

Table 4.8 contains the percentages of technology coordinators who thought these obstacles were hindering realization of the school's pedagogical goals "a lot." The following observations can be made:

- A majority of respondents in only two education systems saw the obstacles as seriously hindering realization of the school's pedagogical goals. These countries were the Russian Federation (in particular with regard to having insufficient computers connected to internet, insufficient ICT equipment for instruction and a lack of ICT-tools for science laboratory work) and Thailand, where most of the obstacles were perceived as very serious, in particular the lack of ICT-tools for science laboratory work.
- In most education systems, a substantial number of technology coordinators saw lack of ICT-tools for science laboratory work as a serious obstacle. The exceptions were Lithuania and Singapore.

- A noteworthy (but not unexpected) finding was the substantial number of schools in Chile, the Russian Federation, South Africa, and Thailand that complained about insufficient budget for non-ICT-supplies (e.g., paper and pencils). Although the percentages were relatively high in these countries, the corresponding percentages in most other wealthy economies could not be deemed negligible.

Another question of potential relevance for educational policy planning is how many computers in a school need to be connected to internet. A tentative answer to this question can be inferred from an examination of the percentages of technology coordinators who reported that an insufficient number of computers connected to internet formed a serious obstacle to realization of their school's pedagogical goals.

We might assume, on the basis of the results shown in Figure 4.3, that schools with a student–internet-computer ratio lower than 10 would be less likely to complain about insufficient internet connectivity. But such complaints doubtless depend to a considerable extent on other factors, such as the pedagogical approach of the school: a lower ratio might be needed when students have to work independently, while higher ratios might be acceptable in situations where the main pedagogical model is based on working in intact classes.

Figure 4.3 Percentages of technology coordinators who perceived the insufficient number of computers connected to the internet as hindering "to a great extent" realization of their pedagogical goals, broken down by student internet-computer-ratio categories

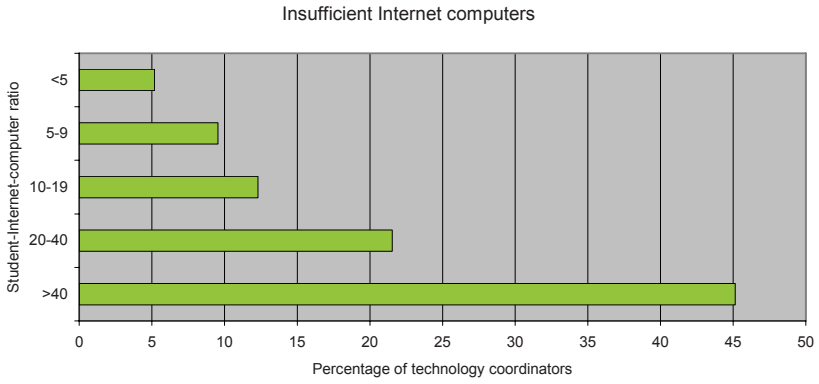


Table 4.8 Percentages (standard errors) of technology coordinators indicating that the school's capacity to realize its pedagogical goals was hindered "a lot" by each of the obstacles listed

Education system	Insufficient computers on internet	Insufficient internet bandwith	Lack ICT for disabled students	Insufficient ICT equipment for instruction	Computers out of date	Not enough digital educational resources for instruction	Lack of ICT tools for science laboratory work	Insufficient budget for non ICT-supplies (e.g., paper, pencils)
[2,3] Alberta Province, Canada	11 (2.9)	6 (2.3)	11 (2.9)	14 (3.4)	18 (3.1)	18 (3.5)	26 (3.8)	18 (3.3)
Catalonia, Spain	8 (1.6)	10 (1.5)	15 (2.1)	20 (2.3)	12 (1.9)	15 (1.9)	16 (2.1)	9 (1.6)
[1] Chile	47 (2.1)	36 (2.0)	23 (2.0)	54 (2.4)	45 (2.4)	48 (2.3)	55 (2.5)	43 (2.6)
Chinese Taipei	5 (1.0)	12 (1.4)	26 (2.2)	18 (1.8)	19 (2.0)	31 (2.4)	46 (2.7)	13 (2.0)
[2] Finland	8 (1.4)	3 (1.0)	3 (1.1)	19 (2.2)	16 (2.2)	25 (2.6)	36 (3.1)	21 (2.6)
[2] Hong Kong SAR	3 (1.1)	5 (1.4)	9 (1.7)	11 (1.9)	38 (3.2)	38 (3.1)	27 (2.8)	9 (1.8)
[4] Israel	29 (2.8)	22 (2.4)	29 (2.5)	43 (2.9)	38 (3.1)	40 (2.7)	42 (3.1)	14 (2.2)
[1] Italy	16 (1.7)	19 (2.2)	20 (2.3)	17 (2.0)	15 (1.9)	21 (2.2)	39 (3.0)	11 (1.8)
[1] Japan	16 (1.8)	24 (2.2)	16 (1.8)	26 (2.1)	27 (2.1)	30 (2.4)	33 (2.4)	16 (1.7)
[2] Lithuania	16 (2.6)	13 (2.2)	4 (1.4)	10 (1.9)	5 (1.5)	7 (1.7)	4 (1.3)	13 (2.3)
Moscow, Russian Federation	39 (2.8)	16 (2.0)	18 (2.2)	50 (2.8)	27 (2.4)	35 (2.6)	51 (2.5)	46 (2.4)
[2] Ontario Province, Canada	17 (2.4)	13 (2.1)	4 (1.3)	26 (2.8)	23 (2.7)	24 (2.8)	47 (3.1)	16 (2.3)
Russian Federation	57 (3.2)	33 (3.0)	20 (2.5)	60 (3.4)	24 (2.4)	47 (4.2)	56 (3.0)	37 (3.4)
Singapore	5 (1.8)	19 (3.2)	4 (1.5)	3 (1.4)	5 (1.8)	20 (3.6)	9 (2.4)	5 (1.8)
Slovak Republic	21 (2.1)	25 (2.4)	31 (2.8)	22 (2.2)	10 (1.6)	35 (2.3)	45 (2.6)	28 (2.4)
Slovenia	10 (1.6)	16 (2.0)	15 (1.8)	28 (2.6)	32 (2.5)	24 (2.4)	46 (2.9)	20 (2.3)
South Africa	53 (2.8)	46 (2.6)	31 (2.6)	50 (2.6)	21 (1.9)	51 (2.7)	57 (2.7)	39 (2.7)
[1] Thailand	68 (2.6)	75 (2.2)	45 (3.0)	72 (2.1)	54 (2.9)	72 (2.3)	77 (2.1)	47 (2.8)
[#] Denmark	10 (2.3)	6 (1.7)	8 (2.1)	12 (1.9)	10 (2.3)	12 (2.3)	47 (3.6)	15 (2.6)
[#] Estonia	13 (2.7)	14 (2.8)	12 (2.7)	27 (3.6)	40 (3.9)	47 (4.0)	51 (4.1)	16 (3.0)
[#] France	15 (2.5)	11 (2.3)	10 (2.0)	21 (3.3)	27 (3.1)	15 (2.7)	28 (3.6)	9 (2.2)
[#] Norway	12 (2.4)	10 (2.4)	9 (2.0)	24 (3.1)	18 (3.3)	25 (3.0)	67 (3.7)	19 (3.6)

Notes:

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

Location

Table 4.9 presents information about where computers were located in schools in the participating systems. In the early days of computerization in schools, most schools created dedicated computer rooms, but found this was not an ideal solution for several reasons. Becker and Ravitz (2001), for example, argued that locating computers in or near the classroom had beneficial effects on integrating ICT in teaching and learning. SITES 2006 accordingly asked technology coordinators to indicate where computers were located in their schools. Table 4.9 summarizes their responses, and the following inferences can be drawn from these.

- In most education systems, the schools' computers were located in computer laboratories.
- In regard to schools that had most of their classrooms equipped with one or more computers, only a few education systems (Alberta, Hong Kong, Norway, and Ontario) had at least 50% of their schools equipped in this way. Several other education systems had almost no such schools. They were Catalonia, Chile, France, Israel, Italy, Lithuania, the Russian Federation, the Slovak Republic, South Africa, and Thailand.
- Computers were also available in the libraries of a substantial number of schools in all education systems except Chile, the Slovak Republic, and South Africa. It is not known if the lack of computers in libraries for these last three systems may have been a case of their schools not having libraries.
- Hong Kong stood out as a system where computers seemed to be available throughout the schools.

Maintenance

With the number of computers in schools increasing, maintenance of this equipment is not a trivial issue for schools. In-house solutions (such as appointing ICT-specialists) may be affordable options for large schools, but they are usually beyond the reach of small schools. Table 4.10 shows the data obtained from technology coordinators on maintenance options. More than one source of maintenance support is evident in the table (in those systems where the sum of row-percentages exceeds 100).

Moreover, staff members in a majority of the schools seem to have been involved in maintaining ICT-equipment. In some education systems, a majority of schools were using external companies hired by

the school (as in Italy, for example) or arranged by the ministry (as in Israel, the Russian Federation, and Singapore).

*Table 4.9 Percentages (standard errors) of technology coordinators reporting where computers were located in their school**

Education system	Most classrooms	Some classrooms	Computer laboratories	Library	Other places
[2,3] Alberta Province, Canada	51 (4.1)	22 (3.3)	91 (2.6)	75 (4.0)	42 (4.1)
Catalonia, Spain	1 (0.7)	33 (2.6)	97 (0.9)	56 (2.9)	33 (2.9)
[1] Chile	2 (0.7)	3 (0.7)	97 (0.7)	23 (2.1)	10 (1.5)
Chinese Taipei	20 (2.1)	26 (2.3)	99 (0.7)	53 (2.4)	29 (2.3)
[2] Finland	38 (3.3)	46 (3.2)	97 (1.1)	42 (3.0)	23 (2.6)
[2] Hong Kong SAR	69 (2.6)	16 (2.4)	99 (0.6)	95 (1.4)	77 (2.8)
[4] Israel	1 (0.7)	22 (2.4)	96 (1.4)	55 (3.1)	35 (3.0)
[1] Italy	3 (0.8)	14 (1.9)	96 (1.0)	27 (2.4)	35 (2.9)
[1] Japan	13 (1.8)	20 (2.2)	99 (0.4)	35 (2.4)	23 (1.9)
[2] Lithuania	3 (1.2)	41 (3.1)	78 (3.1)	72 (3.2)	33 (3.5)
Moscow, Russian Federation	4 (1.0)	52 (2.6)	96 (1.0)	77 (2.1)	36 (2.5)
[2] Ontario Province, Canada	62 (3.3)	19 (2.7)	80 (2.5)	73 (2.9)	27 (2.3)
Russian Federation	0 (0.1)	9 (1.7)	90 (1.6)	36 (2.9)	22 (1.4)
Singapore	31 (3.7)	17 (3.0)	100 (0.0)	93 (2.0)	63 (3.8)
Slovak Republic	0 (0.0)	7 (1.0)	98 (0.7)	9 (1.4)	19 (2.1)
Slovenia	22 (2.3)	55 (2.7)	97 (1.0)	79 (2.1)	28 (2.3)
South Africa	1 (0.6)	3 (0.9)	48 (2.8)	9 (1.5)	12 (2.1)
[1] Thailand	4 (1.1)	17 (1.9)	93 (1.5)	39 (2.3)	43 (3.1)
[#] Denmark	14 (2.7)	27 (3.6)	92 (2.0)	84 (2.8)	63 (4.3)
[#] Estonia	11 (2.6)	40 (3.6)	98 (1.2)	51 (3.8)	17 (2.8)
[#] France	6 (2.1)	70 (3.3)	93 (1.6)	93 (1.4)	40 (3.7)
[#] Norway	48 (3.9)	25 (3.5)	84 (3.3)	73 (3.8)	67 (4.0)

Notes:

[*] Only for schools that possessed computers

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

Table 4.10 Percentages (standard errors) of technology coordinators indicating the maintenance options available in their schools

Education system	The school's own staff	Staff from other schools	External hired company	External arranged by ministry
[2,3] Alberta Province, Canada	78 (3.6)	10 (2.6)	20 (3.0)	49 (4.4)
Catalonia, Spain	93 (1.5)	3 (1.0)	33 (2.4)	44 (1.3)
[1] Chile	66 (2.2)	3 (0.9)	16 (1.9)	52 (2.2)
Chinese Taipei	98 (0.8)	6 (1.4)	56 (2.6)	26 (2.5)
[2] Finland	68 (2.7)	2 (0.8)	13 (2.2)	12 (2.0)
[2] Hong Kong SAR	97 (1.1)	13 (2.3)	59 (3.0)	31 (2.9)
[4] Israel	56 (2.9)	1 (0.6)	18 (2.2)	68 (2.6)
[1] Italy	74 (2.3)	2 (0.9)	72 (2.6)	1 (0.6)
[1] Japan	70 (2.2)	1 (0.4)	27 (2.1)	74 (2.1)
[2] Lithuania	89 (2.4)	8 (2.1)	16 (2.6)	10 (2.3)
Moscow, Russian Federation	74 (2.3)	1 (0.6)	40 (2.6)	61 (2.4)
[2] Ontario Province, Canada	79 (2.8)	9 (1.7)	11 (2.0)	52 (3.3)
Russian Federation	83 (2.1)	5 (1.8)	15 (1.8)	25 (2.9)
Singapore	49 (3.8)	0 (0.0)	49 (3.9)	87 (2.5)
Slovak Republic	90 (1.6)	6 (1.3)	30 (2.3)	5 (1.2)
Slovenia	97 (1.0)	4 (1.0)	49 (2.5)	8 (1.4)
South Africa	42 (2.4)	2 (0.5)	34 (2.3)	11 (1.6)
[1] Thailand	91 (1.7)	15 (2.0)	51 (2.8)	11 (1.8)
[#] Denmark	97 (1.2)	9 (2.3)	14 (2.3)	20 (2.9)
[#] Estonia	92 (2.0)	1 (0.8)	16 (3.1)	19 (3.2)
[#] France	70 (3.0)	21 (2.7)	45 (3.3)	52 (3.2)
[#] Norway	92 (2.4)	4 (1.9)	8 (2.2)	60 (4.4)

Notes :

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

4.2.3 Support (technical and pedagogical)

A necessary condition for sustainable integration of ICT is the existence of an adequate technical support structure. SITES Module 2 found that schools use different approaches to realize technical support, and that the existence of ICT-support (technical as well as pedagogical) is necessary for implementing innovations. This section addresses these questions:

1. Who provides ICT-support to teachers and how much time is spent on these activities each week?
2. To what extent is technical support available for teachers who use ICT for new forms of teaching and learning?

With respect to Question 1, Table 4.11 shows the percentages of schools where various categories of personnel were involved in providing ICT-support. The table also shows the amount of time per week that was available per school for this support, expressed as the number of minutes per student. Across the participating systems, quite a number of different categories of persons were involved, including, in almost all schools, a technology coordinator. Other ICT-staff and teachers were frequently involved. Some noteworthy observations are:

- Denmark, Hong Kong, and Singapore had a high rate of other ICT-staff available in addition to the computer coordinator.
- A majority of schools in Hong Kong, Moscow, and Singapore had students providing support.
- External volunteers were barely involved, except in Moscow.
- The number of weekly minutes (expressed as minutes per student for comparability reasons) differed greatly across education systems, varying from two minutes or less (Catalonia, Chinese Taipei, Finland, France, and South Africa) to 10 minutes or more (in Lithuania and the Russian Federation).

For Question 2, technology coordinators were asked to indicate to what extent teachers had technical support available to them when using ICT for each of 11 different activities in which students played an active role. The overall scale had a reliability of 0.92, and the means and confidence intervals of the 11 scale items for each education system are shown in Figure 4.4. The data in the figure indicate that the degree of support available varied quite substantially across the education systems. In Finland, France, Japan, Ontario, the Russian Federation, and South Africa, for example, the score on this indicator was quite low, while in Chile, Hong Kong, Lithuania, Singapore, Slovenia, and Thailand, the score was much higher.

As teachers become more aware that integration of ICT has implications for their pedagogical approaches, and vice versa, the importance of providing pedagogical as well as technical support becomes more obvious to them. This is especially the case when teachers utilize student-centered approaches, as they are generally more likely to

Table 4.11 Percentages of schools where specific categories of persons are involved in providing technical support

Education system	Computer coordinator	Other ICT staff	Other admin. and staff	Teachers	Students	External volunteers	External companies	Others	Hours per week	Minutes per week per student
[2,3] Alberta Province, Canada	89 (2.8)	42 (4.4)	14 (3.2)	72 (3.6)	13 (2.5)	4 (1.6)	12 (2.7)	14 (3.2)	18 (2.3)	3 (0.6)
Catalonia, Spain	93 (1.6)	47 (2.6)	4 (1.1)	64 (2.6)	7 (1.3)	3 (1.1)	27 (2.3)	4 (1.1)	18 (1.3)	2 (0.2)
[1] Chile	88 (1.7)	30 (2.3)	8 (1.2)	71 (2.0)	31 (2.3)	14 (1.7)	14 (1.8)	8 (1.2)	24 (1.7)	5 (0.7)
Chinese Taipei	94 (1.3)	54 (2.4)	3 (1.0)	60 (2.8)	26 (2.1)	5 (1.0)	33 (2.1)	3 (1.0)	26 (1.3)	2 (0.1)
[2] Finland	97 (1.1)	53 (3.0)	8 (1.7)	53 (3.1)	5 (1.5)	1 (0.5)	11 (2.1)	8 (1.7)	10 (0.9)	2 (0.5)
[2] Hong Kong, SAR	96 (1.2)	96 (1.4)	6 (1.7)	71 (3.3)	61 (3.0)	6 (1.5)	21 (2.7)	6 (1.7)	62 (3.0)	4 (0.5)
[4] Israel	93 (1.7)	43 (2.9)	7 (1.7)	54 (3.3)	27 (2.4)	6 (1.4)	30 (2.8)	7 (1.7)	25 (2.0)	4 (0.7)
[1] Italy	92 (1.4)	30 (2.6)	5 (1.2)	71 (2.1)	6 (1.3)	4 (1.2)	10 (1.6)	5 (1.2)	12 (0.8)	3 (0.6)
[1] Japan	80 (2.2)	39 (2.5)	1 (0.6)	50 (2.8)	34 (2.5)	2 (0.6)	8 (1.3)	1 (0.6)	13 (1.0)	3 (0.5)
[2] Lithuania	97 (1.0)	67 (3.3)	13 (2.4)	95 (1.4)	47 (3.4)	9 (2.2)	11 (2.4)	13 (2.4)	39 (2.6)	10 (0.9)
Moscow, Russian Federation	96 (1.0)	62 (2.5)	8 (1.4)	80 (2.0)	51 (2.6)	24 (1.8)	31 (2.2)	8 (1.4)	47 (2.1)	6 (0.7)
[2] Ontario Province, Canada	74 (3.0)	42 (3.2)	5 (1.4)	61 (3.3)	11 (2.3)	4 (1.2)	7 (1.7)	5 (1.4)	10 (1.3)	3 (1.1)
Russian Federation	87 (2.1)	35 (2.7)	8 (1.4)	70 (2.7)	44 (2.7)	12 (1.9)	15 (1.8)	8 (1.4)	27 (2.3)	11 (1.0)
Singapore	95 (1.8)	95 (1.8)	8 (2.4)	77 (3.6)	54 (3.7)	6 (1.9)	57 (4.0)	8 (2.4)	59 (4.7)	3 (0.2)
Slovak Republic	98 (0.7)	51 (2.7)	13 (1.7)	93 (1.5)	20 (2.2)	18 (1.9)	12 (1.7)	13 (1.7)	30 (1.5)	7 (0.5)
Slovenia	94 (1.2)	59 (2.9)	8 (1.5)	78 (2.1)	38 (2.6)	5 (1.2)	22 (2.2)	8 (1.5)	29 (1.4)	6 (0.4)
South Africa	41 (2.3)	24 (2.2)	4 (1.2)	28 (2.3)	14 (1.9)	3 (0.8)	9 (1.6)	4 (1.2)	13 (1.9)	1 (0.4)
[1] Thailand	86 (2.1)	63 (2.7)	9 (1.8)	81 (2.3)	48 (2.8)	5 (1.2)	11 (1.7)	9 (1.8)	25 (1.3)	4 (0.3)
[#] Denmark	95 (1.7)	72 (3.5)	10 (2.0)	63 (3.9)	4 (1.4)	2 (1.1)	9 (2.1)	10 (2.0)	17 (1.3)	3 (0.4)
[#] Estonia	99 (0.9)	36 (3.6)	6 (2.0)	76 (3.2)	13 (2.6)	5 (1.8)	9 (2.2)	6 (2.0)	27 (2.2)	6 (0.5)
[#] France	83 (2.8)	35 (3.6)	3 (1.2)	53 (4.0)	4 (1.8)	2 (1.1)	10 (2.6)	3 (1.2)	11 (1.1)	1 (0.2)
[#] Norway	100 (0.0)	52 (4.3)	13 (2.6)	74 (3.5)	44 (4.5)	4 (1.8)	16 (2.9)	13 (2.6)	15 (1.5)	4 (0.3)

Notes :

Last column shows available support-minutes per student

[#] School participation rate after including replacement schools is below 70%

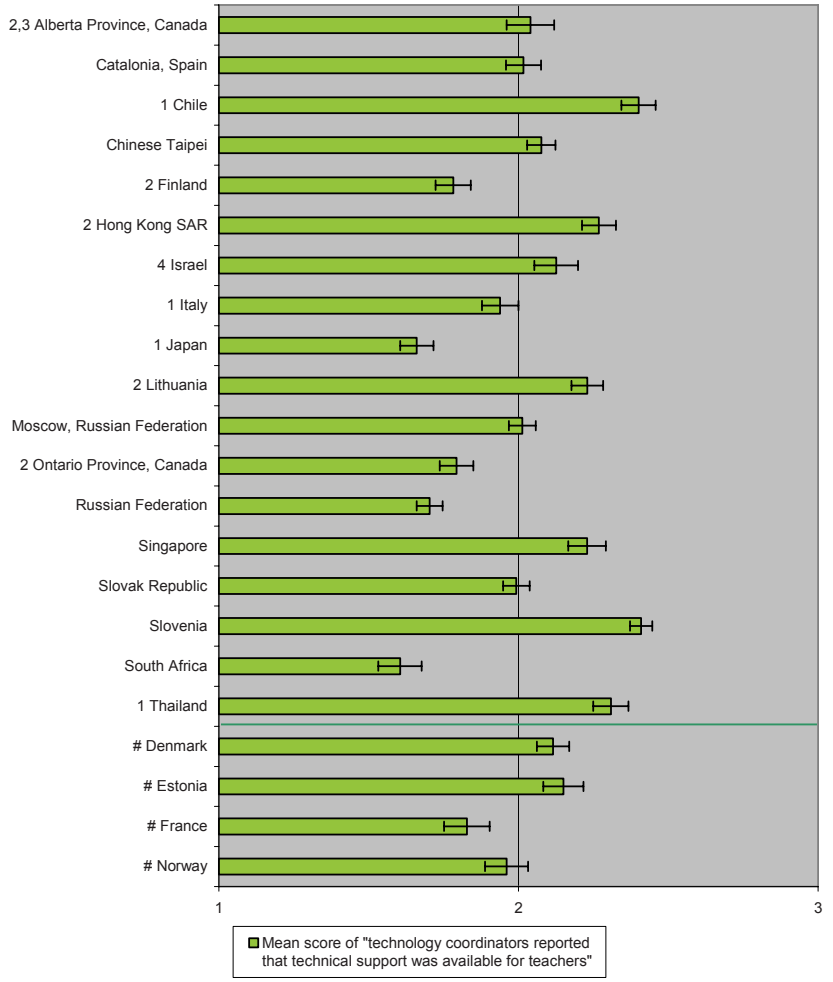
[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

Figure 4.4 Means (across items) and confidence intervals of the extent to which technology coordinators reported that technical support was available for teachers



Notes:

Values for the response categories: 1=no support, 2=some support, 3=extensive support

[#]School participation rate after including replacement schools is below 70%

[1]School participation rate before including replacement schools is below 85%

[2]School participation rate after including replacement schools is below 85%

[3]Less than 70% of the school-level questionnaires in the participating schools were returned

[4]Nationally defined population covers less than 90% of the nationally desired population.

be confronted with issues like how to manage activities such as project work, online collaboration, field studies, and so on. An idea of the extent to which pedagogical support was available (1 = not at all, 2 = a little, 3 = somewhat, 4 = a lot) was obtained by asking school principals to indicate the extent to which pedagogical support was available for teachers for each of the following activities: (a) having students produce outcomes related to media production projects (e.g., websites); (b) having students work on short projects (two weeks or less); (c) having students work on extended projects (longer than two weeks); (d) having students collaborate with others by online means, such as online discussion forums; (e) having students conduct open-ended scientific investigations; and (f) having students engage in field-study activities.

These items were used to construct a composite indicator of pedagogical support (reliability 0.87), for which the means and confidence intervals are shown in Figure 4.5. The availability of pedagogical support for these learning activities was relatively low in Catalonia, Finland, and the Russian Federation, but relatively high in Hong Kong and Lithuania.

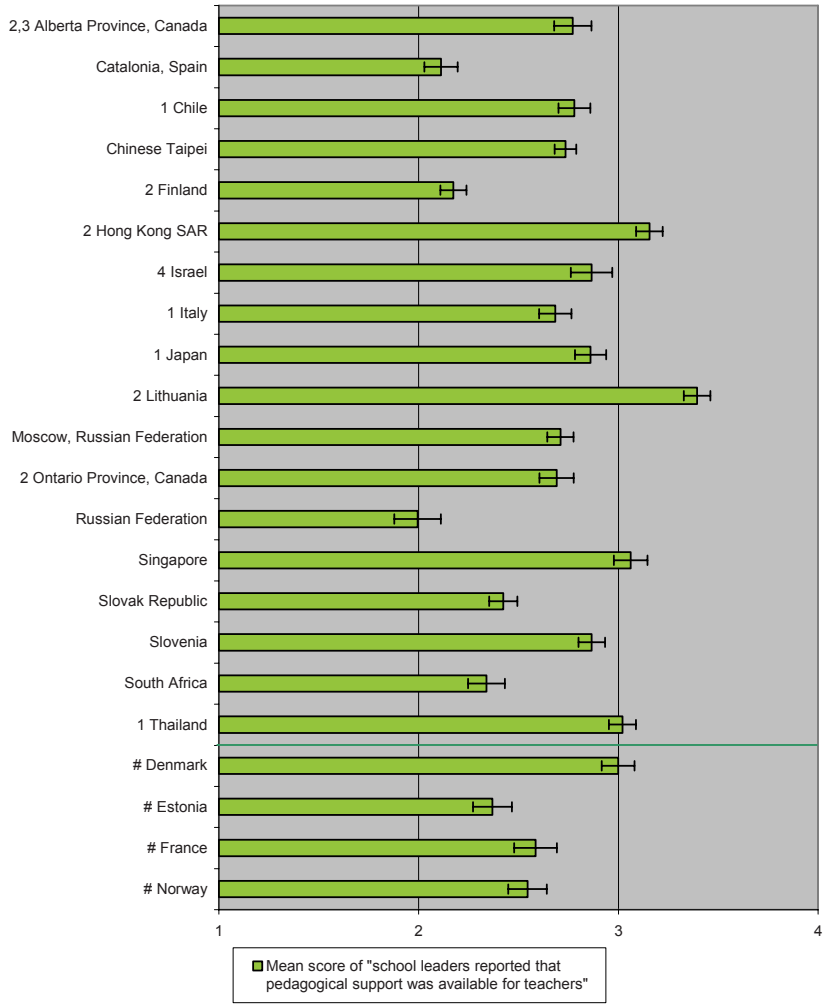
The large variation among education systems with regard to the support indicators raises the question of how this situation relates to the experiences of teachers regarding the availability of support (see Chapter 6). Also important to investigate is the question of whether this variation is associated with the people who provide this support, such as experienced colleagues, the school principal, technology coordinators, other school staff, and experts from outside the school (see Table 4.11 above). These questions are of interest for secondary analyses.

4.2.4 Staff development

Because policy directions in school systems tend toward increased use of ICT in schools, the need for staff development programs in this area is bound to increase. According to Jones (2004), teachers lacking confidence and competence can be a major obstacle to effective implementation of ICT. Pelgrum (2001) showed that school principals involved in SITES Module 1 identified this obstacle as a serious one. In SITES 2006, school principals and technology coordinators were asked to what extent they thought each of 15 potential obstacles seriously hindered the capacity of the school to realize its pedagogical goals. As shown in Table 4.12, teachers' lack of ICT-skills did not receive the highest ranking in this list,

but about a quarter of all respondents did say that this obstacle hindered the realization of the school's pedagogical goals "a lot."

Figure 4.5 Means (across items) and confidence intervals of the extent to which school leaders reported that pedagogical support was available for teachers



Notes:

Values for the response categories: 1=no support, 2=some support, 3=extensive support

[#]School participation rate after including replacement schools is below 70%

[1]School participation rate before including replacement schools is below 85%

[2]School participation rate after including replacement schools is below 85%

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[4]Nationally defined population covers less than 90% of the nationally desired population.

Table 4.12 Average percentages (across education systems) of school principals marking obstacles hindering realization of the school's pedagogical goals "a lot"

Obstacle	%	Obstacle	%
Lack of ICT-tools for science laboratory work	40	Computers are out of date	21
Insufficient ICT-equipment for instruction	31	Insufficient internet bandwidth or speed	21
Not enough digital educational resources for instruction	31	Lack of special ICT-equipment for disabled students	20
Insufficient time for teachers to use ICT	30	Insufficient or inappropriate space to accommodate the school's pedagogical approaches	19
Insufficient qualified technical personnel to support the use of ICT	29	Prescribed curricula are too strict	19
Insufficient number of computers connected to the internet	27	Pressure to score highly on standardized tests	18
Insufficient budget for non-ICT-supplies (e.g., paper, pencils)	25	Using ICT for teaching and/or learning is not a goal of our school	6
Teachers' lack of ICT-skills	23		

Jones (2004) suggested several reasons why teachers lack competence and/or confidence in regard to making ICT part of their pedagogical practice. These include lack of time for training, lack of pedagogical training, and lack of fit between training opportunities and teacher needs. Jones also suggests that this obstacle can be addressed in several ways, including measures that the school leadership might take. The SITES researchers therefore deemed it important to investigate to what extent school leaders were facilitating and stimulating teachers to update their knowledge and skills regarding pedagogy and ICT. Another area examined was the availability of professional development for teachers. SITES 2006 addressed three questions in this area:

1. Are school leaders stimulating, facilitating, or requiring teachers to acquire knowledge and skills to help teachers deal with new pedagogical approaches?
2. What channels are used to deliver training?
3. What training facilities are available to teachers?

With regard to Question 1, school principals were asked whether teachers were encouraged or required to acquire knowledge and skills in the 10 areas shown along the top of Table 4.13. The table shows the percentage of respondents from each education system who indicated whether teachers in their schools were required to have knowledge and

skills in each of these areas. In most education systems, hardly any or a small minority of the schools required teachers to be trained in these areas. In Catalonia and in Italy, such requirements barely existed. The percentages were comparatively high in Japan, the Russian Federation, Singapore, South Africa, and Thailand.

With Question 2, respondents were asked which of the 10 ways listed across the top of Table 4.14 their schools were using to help teachers acquire ICT-related knowledge and skills. The table shows the percentage of schools in which each of the options was available. Schools were using a variety of methods to address this issue, but the most common were informal, such as the ICT-coordinator exchanging information with and via colleagues. Staff training conducted by an in-school ICT-committee was less common in all systems except Hong Kong, Singapore, and Thailand. External courses were also quite popular, in particular in Denmark, Lithuania, Moscow, and Singapore, but there was little evidence of them in France.

Respondents were also asked which of seven types of courses were available for teachers and whether these courses were school-based or provided by external agencies. Table 4.15 summarizes the results for this item. It shows the percentage of respondents who indicated, for each course, whether it was available to teachers via in-school and/or external sources. In South Africa, only a relatively small number of schools indicated that such courses were available. Except for introductory courses, this was also the case in Chile. Technical courses for operating and maintaining computer systems were available in 75% or more of the schools in Estonia, the Slovak Republic, and Slovenia. Less than a quarter of the schools in Israel and South Africa reported the availability of these types of courses.

Courses on pedagogical issues related to integrating ICT into teaching and learning were available in more than three-quarters of the schools in Chinese Taipei, Denmark, Estonia, Hong Kong, Lithuania, Moscow, Singapore, and Slovenia. However, there were also quite a few education systems (Alberta, Chile, Finland, Israel, Italy, Japan, France, Norway, South Africa, and Thailand) where sizeable numbers of schools did not seem to have access to such courses. Note, however, that the results in Table 4.15 reflect the perceptions of the respondents, which may have been influenced by a lack of awareness of the existence of particular courses. This surmise is evident in the following comment from Finnish colleagues:

Table 4.13 Percentages (standard errors) of schools requiring acquisition of knowledge and skills in the listed topics

Education system	Integrating web-based learning	Using new ways of assessment	Developing real-life assignments for students	Using real-life assignments developed by others	Using computers for monitoring student progress	Organizing forms of team-teaching	Collaborating with other teachers via ICT	Communicating with parents via ICT	Being knowledgeable about the pedagogical issues of integrating ICT into teaching and learning	Using subject-specific learning software (e.g., tutorials, simulation)
[2,3] Alberta Province, Canada	8 (2.0)	18 (2.9)	10 (2.3)	6 (1.9)	54 (3.9)	12 (2.4)	8 (2.2)	15 (2.8)	26 (3.5)	13 (2.9)
Catalonia, Spain	1 (0.6)	3 (0.9)	6 (1.3)	3 (0.9)	7 (1.5)	6 (1.4)	5 (1.3)	3 (1.1)	9 (1.4)	4 (1.1)
[1] Chile	8 (1.3)	13 (1.8)	26 (2.2)	14 (1.7)	13 (1.8)	23 (2.3)	6 (1.1)	4 (0.9)	11 (1.6)	11 (1.6)
Chinese Taipei	9 (1.7)	15 (2.0)	9 (1.4)	4 (1.0)	5 (1.1)	15 (2.0)	8 (1.3)	3 (1.0)	21 (2.0)	12 (1.6)
[2] Finland	2 (0.8)	2 (0.8)	7 (1.8)	3 (1.2)	8 (1.7)	1 (0.7)	7 (1.7)	11 (2.0)	2 (0.9)	3 (1.1)
[2] Hong Kong SAR	7 (1.8)	7 (1.8)	6 (1.8)	3 (1.2)	5 (1.5)	8 (1.9)	5 (1.5)	4 (1.5)	9 (2.0)	8 (2.0)
[4] Israel	17 (2.5)	23 (2.7)	24 (2.9)	16 (2.3)	24 (2.5)	23 (2.9)	16 (2.3)	7 (1.6)	29 (3.0)	22 (2.6)
[1] Italy	1 (0.7)	15 (2.4)	5 (1.1)	0 (0.0)	2 (0.8)	2 (0.8)	1 (0.6)	0 (0.0)	4 (1.2)	2 (0.7)
[1] Japan	39 (2.2)	35 (2.3)	47 (2.3)	26 (2.2)	31 (2.5)	43 (2.4)	23 (2.0)	9 (1.4)	19 (1.8)	25 (2.1)
[2] Lithuania	7 (1.7)	13 (2.5)	18 (2.9)	15 (2.6)	9 (1.9)	13 (2.5)	16 (2.6)	16 (2.5)	8 (1.9)	15 (2.4)
Moscow, Russian Federation	44 (2.5)	30 (2.3)	31 (2.5)	23 (2.1)	34 (2.2)	32 (2.4)	33 (2.4)	37 (2.3)	39 (2.7)	43 (2.5)
[2] Ontario Province, Canada	7 (1.6)	31 (2.8)	19 (2.4)	8 (1.4)	20 (2.3)	9 (1.8)	10 (1.8)	6 (1.5)	12 (1.8)	10 (1.6)
Russian Federation	60 (3.3)	44 (3.2)	42 (3.1)	28 (3.5)	39 (3.6)	39 (3.2)	44 (3.2)	43 (2.8)	49 (3.4)	47 (2.6)
Singapore	20 (3.2)	28 (3.9)	20 (3.2)	8 (2.4)	38 (4.1)	17 (3.2)	11 (2.7)	15 (2.7)	34 (4.0)	32 (3.9)
Slovak Republic	5 (1.2)	8 (1.4)	20 (2.1)	14 (1.9)	15 (2.0)	10 (1.6)	13 (1.8)	4 (1.0)	15 (1.8)	5 (1.2)
Slovenia	7 (1.3)	7 (1.6)	11 (1.4)	5 (1.2)	10 (1.6)	10 (1.7)	11 (1.9)	2 (0.9)	10 (1.8)	16 (2.1)
South Africa	24 (2.4)	43 (2.1)	31 (2.1)	24 (2.1)	26 (2.6)	28 (2.1)	24 (2.5)	20 (2.5)	25 (2.4)	25 (2.5)
[1] Thailand	44 (2.7)	66 (2.6)	52 (2.6)	39 (3.0)	65 (2.8)	53 (2.9)	56 (2.9)	28 (2.7)	46 (2.9)	42 (2.9)
[#] Denmark	4 (1.3)	20 (2.8)	2 (1.0)	1 (0.7)	5 (1.6)	8 (2.0)	14 (2.1)	10 (2.0)	13 (2.6)	8 (2.0)
[#] Estonia	8 (1.9)	6 (1.8)	25 (3.2)	12 (2.5)	13 (2.4)	8 (2.0)	15 (2.8)	24 (3.5)	21 (2.8)	12 (2.6)
[#] France	2 (1.0)	2 (1.0)	3 (1.1)	1 (0.8)	7 (1.8)	23 (3.1)	4 (1.3)	2 (1.1)	5 (1.5)	3 (1.5)
[#] Norway	6 (2.2)	11 (2.6)	4 (1.6)	0 (0.0)	9 (2.5)	5 (1.6)	14 (2.3)	13 (2.6)	11 (2.5)	2 (0.4)

Notes :

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

Table 4.14 Percentages (standard errors) of schools using particular channels for teachers to acquire knowledge and skills

Education system	Informal contacts/ communication	ICT coordinator or technical assistant	In-school courses	Training from a teacher who has attended a course	School's working group or committee for ICT in education	Meetings of the teaching staff	Regular newsletter (printed or electronic)	Courses conducted by an external agency or expert (in the school or at distance)	Observation of and discussion with colleagues	Reading professional journals and similar publications
[2,3] Alberta Province, Canada	96 (1.7)	86 (2.9)	70 (3.8)	80 (3.2)	59 (4.2)	51 (4.3)	15 (2.9)	56 (4.5)	95 (1.9)	48 (4.2)
Catalonia, Spain	75 (2.1)	82 (2.2)	80 (2.4)	69 (2.6)	18 (1.8)	24 (2.2)	10 (1.6)	50 (3.0)	75 (2.3)	28 (2.6)
[1] Chile	67 (2.1)	76 (1.9)	64 (2.4)	64 (2.4)	21 (1.9)	35 (2.2)	10 (1.5)	43 (2.2)	81 (1.6)	40 (2.4)
Chinese Taipei	78 (2.1)	76 (2.3)	86 (1.7)	92 (1.3)	44 (2.1)	40 (2.5)	38 (2.7)	57 (2.7)	94 (1.4)	70 (2.2)
[2] Finland	87 (2.0)	89 (1.9)	71 (2.8)	62 (3.0)	29 (2.9)	17 (2.3)	10 (1.9)	73 (3.1)	92 (1.7)	70 (3.0)
[2] Hong Kong SAR	95 (1.4)	99 (0.6)	94 (1.5)	91 (2.0)	94 (1.5)	51 (3.1)	39 (3.3)	65 (3.0)	91 (1.9)	72 (2.7)
[4] Israel	60 (3.0)	75 (2.5)	70 (3.3)	69 (2.7)	23 (2.2)	23 (2.6)	10 (1.8)	47 (3.3)	37 (2.6)	26 (2.7)
[1] Italy	66 (2.8)	76 (2.4)	83 (2.2)	63 (2.9)	29 (2.8)	17 (2.0)	3 (1.0)	69 (2.8)	55 (2.7)	41 (2.6)
[1] Japan	85 (1.9)	67 (2.2)	58 (2.6)	59 (2.3)	26 (2.2)	19 (2.1)	10 (1.6)	45 (2.6)	91 (1.4)	64 (2.4)
[2] Lithuania	69 (3.2)	85 (2.6)	74 (3.2)	90 (2.1)	21 (2.5)	26 (3.2)	38 (3.5)	82 (2.6)	88 (2.4)	74 (3.0)
Moscow, Russian Federation	92 (1.3)	76 (2.3)	46 (2.6)	59 (2.5)	28 (2.5)	45 (2.6)	34 (2.4)	90 (1.5)	90 (1.6)	70 (2.3)
[2] Ontario Province, Canada	94 (1.6)	89 (2.2)	67 (3.5)	83 (2.5)	45 (3.3)	47 (3.1)	28 (2.9)	57 (2.8)	94 (1.4)	48 (3.2)
Russian Federation	85 (1.5)	48 (3.2)	45 (3.9)	71 (2.5)	19 (2.7)	33 (2.8)	27 (3.0)	72 (3.1)	85 (2.3)	64 (2.5)
Singapore	96 (1.5)	94 (2.0)	98 (1.2)	91 (2.2)	82 (2.8)	77 (3.1)	36 (3.9)	93 (1.9)	92 (2.2)	56 (4.1)
Slovak Republic	86 (1.9)	85 (1.8)	74 (2.1)	57 (2.8)	14 (1.5)	26 (2.4)	17 (2.3)	73 (2.5)	53 (2.7)	77 (2.1)
Slovenia	90 (1.5)	96 (1.1)	87 (1.7)	53 (2.8)	13 (1.9)	27 (2.3)	53 (2.6)	72 (2.4)	93 (1.2)	71 (2.7)
South Africa	46 (2.4)	26 (2.1)	31 (2.2)	41 (2.7)	15 (1.7)	14 (1.8)	11 (1.9)	32 (2.5)	44 (2.8)	24 (2.5)
[1] Thailand	90 (1.8)	70 (2.6)	76 (2.6)	87 (1.6)	67 (2.9)	50 (3.1)	59 (2.6)	74 (2.2)	77 (2.3)	74 (2.5)
[#] Denmark	82 (2.7)	93 (1.8)	91 (2.1)	70 (3.2)	50 (3.4)	39 (3.2)	15 (2.7)	80 (2.7)	70 (2.9)	52 (3.6)
[#] Estonia	93 (2.1)	93 (2.1)	81 (2.8)	66 (3.7)	20 (2.6)	31 (3.6)	28 (3.6)	79 (3.1)	95 (1.7)	71 (3.5)
[#] France	89 (2.3)	78 (3.1)	60 (3.6)	80 (2.7)	14 (2.1)	20 (2.7)	8 (1.8)	16 (2.3)	98 (1.0)	35 (3.8)
[#] Norway	95 (1.8)	97 (1.5)	93 (2.2)	71 (3.8)	25 (3.4)	18 (3.0)	17 (3.0)	75 (3.7)	86 (3.3)	50 (4.0)

Notes :

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

Table 4.15 Percentages (standard errors) of schools where different types of courses were available for teachers, internally and/or externally

Education system	Introductory course for internet use and general applications (basic word-processing, spreadsheet, databases, etc.)	Technical course for operating and maintaining computer systems	Advanced course for applications/standard tools (e.g., advanced word processing, complex relational databases)
[2,3] Alberta Province, Canada	85 (2.8)	40 (4.2)	64 (3.9)
Catalonia, Spain	85 (2.2)	59 (2.7)	76 (2.4)
[1] Chile	54 (2.6)	26 (1.9)	26 (1.9)
Chinese Taipei	85 (1.9)	65 (2.4)	60 (2.3)
[2] Finland	68 (3.1)	42 (3.5)	51 (3.1)
[2] Hong Kong SAR	90 (1.9)	57 (3.1)	71 (3.0)
[4] Israel	62 (3.1)	18 (2.2)	46 (3.4)
[1] Italy	72 (2.5)	28 (2.6)	39 (2.8)
[1] Japan	65 (2.6)	56 (2.6)	47 (2.8)
[2] Lithuania	98 (0.9)	52 (3.8)	84 (2.5)
Moscow, Russian Federation	92 (1.3)	61 (2.7)	66 (2.4)
[2] Ontario Province, Canada	79 (2.7)	40 (3.0)	71 (3.1)
Russian Federation	77 (2.9)	57 (4.1)	57 (5.0)
Singapore	86 (3.0)	57 (3.9)	78 (3.4)
Slovak Republic	97 (0.8)	78 (2.3)	62 (2.8)
Slovenia	97 (1.0)	76 (2.5)	87 (1.8)
South Africa	32 (2.3)	19 (2.1)	21 (2.2)
[1] Thailand	81 (2.4)	59 (3.0)	38 (2.7)
[#] Denmark	87 (2.6)	55 (3.9)	55 (3.7)
[#] Estonia	97 (1.4)	79 (3.1)	81 (3.3)
[#] France	73 (3.5)	50 (3.5)	51 (3.6)
[#] Norway	78 (3.6)	51 (4.0)	40 (4.0)

Notes :

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> … the availability of external courses is rather good, courses are organized e.g. by Open University, National Board of Education etc. However, teachers are not obliged to participate in PD on ICT use. Thus, usually participants are those teachers who already are interested in the use of ICT. It could also be more a question about whether schools have enough information about the available courses and how actively teachers are encouraged to participate in the courses. And this

Table 4.15 Percentages (standard errors) of schools where different types of courses were available for teachers, internally and/or externally (Continued)

Education system	Advanced course for internet use (e.g., creating websites/developing a home page, advanced use of internet, video conferencing)	Course on pedagogical issues related to integrating ICT into teaching and learning	Subject-specific training with learning software for specific content goals (e.g., tutorials, simulation, etc.)	Course on multimedia use (e.g., digital video and/or audio equipment)
[2,3] Alberta Province, Canada	71 (3.7)	64 (3.8)	69 (4.1)	76 (3.6)
Catalonia, Spain	79 (2.4)	72 (2.8)	60 (2.5)	71 (2.5)
[1] Chile	24 (1.9)	51 (2.1)	32 (2.0)	22 (1.8)
Chinese Taipei	75 (2.4)	91 (1.3)	46 (2.6)	81 (2.0)
[2] Finland	57 (2.9)	47 (3.1)	34 (3.0)	54 (3.4)
[2] Hong Kong SAR	78 (2.6)	77 (2.8)	68 (2.7)	75 (2.8)
[4] Israel	47 (3.6)	57 (3.2)	43 (3.2)	29 (2.7)
[1] Italy	44 (2.6)	44 (2.9)	26 (2.3)	40 (2.8)
[1] Japan	50 (2.5)	40 (2.4)	37 (2.2)	48 (2.4)
[2] Lithuania	86 (2.6)	92 (1.7)	92 (2.0)	82 (2.8)
Moscow, Russian Federation	80 (2.2)	85 (2.0)	90 (1.7)	79 (2.4)
[2] Ontario Province, Canada	73 (2.9)	69 (2.9)	79 (2.7)	76 (2.8)
Russian Federation	58 (4.6)	74 (3.8)	77 (3.8)	59 (4.4)
Singapore	85 (3.0)	83 (2.9)	83 (3.0)	93 (2.2)
Slovak Republic	63 (2.6)	66 (2.5)	58 (2.5)	57 (2.6)
Slovenia	86 (1.9)	79 (2.3)	76 (2.4)	85 (2.0)
South Africa	16 (2.1)	15 (2.0)	17 (2.0)	13 (1.8)
[1] Thailand	67 (2.5)	58 (2.9)	39 (2.8)	33 (2.3)
[#] Denmark	68 (3.3)	87 (2.5)	87 (2.4)	91 (2.0)
[#] Estonia	83 (3.1)	88 (2.6)	86 (2.7)	86 (2.9)
[#] France	58 (3.5)	58 (3.3)	50 (3.6)	66 (3.2)
[#] Norway	48 (4.2)	65 (3.9)	66 (3.8)	63 (4.1)

Notes :

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is, again, related to whether schools are active and interested in the use of ICT. This question of information is of course related to the question of access.

4.2.5 *Leadership development priorities*

School leaders need to possess competencies in handling educational innovations in the school. Previous research (BECTA, 2004; McCluskey, 2004) shows that school leaders are change agents, and that their

Table 4.16 Percentages (standard errors) of schools expressing a high priority for training in several areas

Education system	Developing a common pedagogical vision among teaching staff in the school	Managing the innovation of pedagogical practices in the school	Explaining to teachers the relevance of encouraging students to be responsible for their own learning process and outcomes	Identifying best practices that exist outside the school regarding the integration of ICT in learning	Promoting collaboration between teachers of different subjects
[2,3] Alberta Province, Canada	66 (3.8)	45 (3.7)	53 (3.9)	34 (3.6)	58 (4.0)
Catalonia, Spain	79 (2.2)	61 (2.8)	50 (2.7)	25 (2.5)	58 (2.6)
[1] Chile	93 (1.2)	88 (1.7)	93 (1.2)	56 (2.3)	86 (1.6)
Chinese Taipei	79 (2.2)	62 (2.6)	50 (3.0)	30 (2.5)	29 (2.3)
[2] Finland	61 (3.7)	22 (2.5)	55 (3.3)	12 (2.0)	52 (3.4)
[2] Hong Kong SAR	45 (3.8)	47 (3.5)	32 (3.5)	9 (1.9)	34 (3.3)
[4] Israel	79 (2.3)	62 (3.1)	67 (3.2)	30 (2.7)	51 (3.1)
[1] Italy	73 (2.5)	59 (2.8)	74 (2.4)	35 (2.4)	70 (2.5)
[1] Japan	65 (2.4)	39 (2.4)	20 (1.9)	4 (1.0)	38 (2.4)
[2] Lithuania	58 (3.0)	31 (3.4)	74 (3.4)	17 (2.6)	65 (3.2)
Moscow, Russian Federation	79 (2.1)	62 (2.5)	82 (2.0)	47 (2.6)	77 (2.0)
[2] Ontario Province, Canada	82 (2.2)	61 (2.8)	58 (2.7)	36 (2.6)	65 (2.9)
Russian Federation	55 (3.5)	46 (3.8)	67 (3.5)	36 (3.6)	58 (3.3)
Singapore	68 (4.1)	61 (4.0)	65 (4.0)	42 (4.1)	47 (4.5)
Slovak Republic	51 (2.5)	63 (2.4)	73 (2.2)	29 (2.5)	56 (2.6)
Slovenia	51 (2.5)	53 (2.7)	66 (2.7)	19 (2.1)	58 (2.8)
South Africa	78 (2.1)	69 (2.4)	77 (2.3)	46 (2.6)	71 (2.3)
[1] Thailand	83 (2.1)	82 (2.2)	81 (2.2)	63 (2.9)	71 (2.5)
[#] Denmark	74 (3.1)	64 (3.6)	38 (3.6)	15 (2.5)	53 (3.7)
[#] Estonia	85 (2.7)	56 (3.7)	83 (3.1)	28 (3.3)	70 (3.6)
[#] France	69 (3.0)	54 (3.6)	51 (3.5)	23 (3.0)	68 (3.5)
[#] Norway	68 (3.8)	62 (3.7)	39 (4.4)	18 (3.1)	52 (4.3)

Notes :

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qualifications in this area are sometimes insufficient. In order to gain an indication of what sort of competencies school leaders need to acquire to manage educational changes effectively, the SITES research team asked the participating school principals to specify the extent to which they thought school leaders needed each of 10 competencies.

Table 4.16 shows the percentages of school principals who saw acquisition of each of these competencies as a high priority. Although the principals in most systems accorded high priority to a good number of the competencies, the principals in Japan gave relatively low rankings.

Table 4.16 Percentages (standard errors) of schools expressing a high priority for training in several areas (Continued)

Education system	Managing the adoption of ICT-supported methods for assessing student progress	Organizing cooperation with other schools regarding the development of teaching and learning materials	Organizing cooperation with other schools regarding the development of ICT based teaching and learning	Promoting the integration of ICT in the teaching and learning of traditional subjects	Developing a strategic plan for integrating ICT-use in teaching and learning
[2,3] Alberta Province, Canada	27 (3.2)	23 (3.2)	16 (2.8)	44 (3.8)	30 (3.4)
Catalonia, Spain	26 (2.5)	10 (1.6)	11 (1.5)	51 (3.1)	37 (2.7)
[1] Chile	56 (2.2)	36 (2.0)	32 (2.4)	71 (2.5)	70 (2.5)
Chinese Taipei	33 (2.5)	13 (1.7)	16 (1.8)	36 (2.6)	48 (2.6)
[2] Finland	15 (2.3)	7 (1.7)	8 (1.8)	19 (2.6)	22 (2.9)
[2] Hong Kong SAR	10 (2.1)	4 (1.5)	4 (1.4)	21 (2.9)	23 (3.1)
[4] Israel	32 (2.7)	19 (2.0)	14 (2.0)	31 (3.1)	34 (3.1)
[1] Italy	22 (2.2)	22 (2.4)	18 (2.3)	45 (2.7)	39 (2.6)
[1] Japan	8 (1.4)	7 (1.4)	4 (1.0)	5 (1.2)	5 (1.2)
[2] Lithuania	23 (2.9)	24 (3.2)	17 (2.6)	45 (2.9)	32 (3.2)
Moscow, Russian Federation	54 (2.5)	38 (2.3)	38 (2.3)	65 (2.5)	64 (2.6)
[2] Ontario Province, Canada	25 (2.6)	21 (2.4)	11 (1.8)	39 (2.9)	24 (2.3)
Russian Federation	42 (3.4)	38 (3.0)	37 (3.1)	46 (3.8)	43 (3.9)
Singapore	32 (3.7)	18 (3.3)	15 (3.3)	48 (4.1)	64 (3.7)
Slovak Republic	21 (2.5)	11 (1.9)	16 (2.0)	42 (2.9)	30 (2.5)
Slovenia	8 (1.4)	8 (1.5)	8 (1.6)	17 (2.2)	17 (1.9)
South Africa	48 (2.8)	56 (2.6)	43 (2.7)	44 (2.6)	48 (2.7)
[1] Thailand	66 (2.7)	61 (2.5)	63 (2.5)	74 (2.5)	75 (2.4)
[#] Denmark	12 (2.3)	8 (2.0)	9 (2.1)	32 (3.2)	39 (3.8)
[#] Estonia	22 (3.1)	17 (2.8)	17 (2.7)	39 (3.8)	46 (3.9)
[#] France	31 (2.9)	10 (2.1)	11 (2.1)	42 (3.3)	30 (3.0)
[#] Norway	13 (2.8)	13 (2.5)	16 (2.9)	27 (3.8)	35 (4.1)

Notes :

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Overall, substantial numbers of principals across the systems thought it highly necessary for school leaders to acquire competency in developing a common pedagogical vision among their teaching staff. However, beyond this finding, the differences between education systems in terms of the other competencies are quite striking. For instance:

- In Chile, nearly 90% of the school leaders expressed a need for training with regard to managing innovation, whereas this was the case in about one third of the schools in Japan and Lithuania.

- Explaining to teachers the relevance of encouraging students to be responsible for their own learning processes and outcomes was seen as a high training priority for 93% of the schools in Chile, but only 20% of the schools in Japan. This finding may be a product of the two systems' reform-oriented pedagogical vision for school management, which, as reported in Table 4.2, was relatively high in Chile and low in Japan.
- Most education systems deemed "Managing the adoption of ICT-supported methods for assessing student progress" a low-priority area, even though previous research (Voogt & Pelgrum, 2003) has shown this is a challenging one for educational practitioners.
- Similarly, most of the systems did not accord high priority to "Identifying best practices that exist outside the school regarding the integration of ICT in learning."

4.2.6 Organization and management

When ICT is introduced in schools, a number of organizational and management issues must be considered, solutions to potential problems found, and appropriate actions undertaken. The kinds of issues that may arise include, for example, health risks for students who spend too much time working at computers; "hacking" or unauthorized system access; students spending too much time playing games on school computers; regulating access to computers; and preventing access to adult-only web sites.

School principals were asked to indicate which of 12 possible actions (listed along the top row of Table 4.17) they had undertaken to address these kinds of issues. The cells of Table 4.17 contain the percentages of school principals who indicated that they had taken these actions. Principals in most countries said they had set up security measures, allowed students to use school computers outside of school hours, limited game playing, and specified skills that students were expected to acquire. Measures restricting the number of hours that students could use the computers appeared to be most prevalent in the Russian Federation and Thailand, but of little consequence in Denmark and Hong Kong. Many schools in Chinese Taipei, Hong Kong, and Singapore took measures to provide laptops for teachers. In most schools in Hong Kong, this was also the case with regard to students.

Principals were also asked to indicate the kinds of organizational measures their schools had undertaken to facilitate change and renewal.

They were shown a set of 11 possible measures (listed in the top row of Table 4.18) and asked to indicate which of them they had used. Re-allocating workload to allow for collaborative planning took place in 80% or more of the schools in Chile, Norway, Singapore, and Thailand, but this practice was much less frequently employed in Estonia (43%), Finland (47%), and France (30%). Reviewing the pedagogical approaches used by teachers occurred in most schools in most countries, but not in Finland. Chinese Taipei, Moscow, Norway, and Thailand had all implemented incentive schemes to encourage teachers to use ICT in their lessons, but Finland, Japan, and Slovenia had rarely done so. Many schools in Hong Kong involved parents in ICT-related activities, but France and Japan seemed disinclined to do this.

Principals were additionally asked to indicate how frequently they attempted to stimulate communication about teaching and learning within their own school as well as with members of the wider community. They were presented with a list of 13 possibilities (shown in the top row of Table 4.19) and asked to indicate how often they undertook each such action (answer options were not at all, a few times in the school year, monthly or weekly). The results showed large differences among education systems with respect to management of change. For instance, in Finland and Hong Kong, these actions were rarely undertaken on a regular basis, but in Chile, Ontario, and the Slovak Republic, quite a number of these actions seemed to occur regularly in many schools.

The topics in the last four columns of Table 4.19 focus on cooperation among teachers. It appears that school leaders in a large majority of schools across the education systems encouraged co-teaching, as well as cooperation with colleagues from other schools. Encouragement of cooperation with colleagues from other schools occurs less frequently in Denmark and Israel. School leaders in Estonia and the Slovak Republic seemed not to favor co-teaching. The results also show that school leaders encouraged teachers to discuss professional problems with their colleagues, while in some education systems (notably Catalonia, Chinese Taipei, France, Italy, Japan, and Thailand), school leaders encouraged international cooperation. This latter practice rarely occurred in other systems (e.g., Alberta, Israel, Norway, and Ontario).

Table 4.17 Percentages (s.e.) of schools that had taken particular measures relating to management/organizational issues

Education system	Security measures	Restricting hours student use	Access outside school hours	Access outside class hours	Honoring intellectual property	Prohibitng access adult-only	Restricting game playing	Specifying computer-related knowledge	Community access	Complementing printed materials with digital	Provide laptops to teachers	Provide laptops to students
[2,3] Alberta Province, Canada	98 (1.2)	43 (3.9)	50 (3.9)	94 (1.8)	96 (1.6)	100 (0.3)	88 (2.6)	91 (2.2)	31 (3.3)	92 (1.9)	40 (3.6)	26 (3.5)
Catalonia, Spain	91 (1.6)	63 (2.8)	39 (2.7)	57 (3.0)	81 (2.6)	91 (1.7)	91 (1.7)	87 (1.9)	40 (2.8)	82 (2.3)	42 (2.7)	7 (1.5)
[1] Chile	93 (1.3)	55 (2.2)	77 (2.1)	83 (1.7)	87 (1.7)	98 (0.7)	90 (1.6)	89 (1.5)	71 (2.3)	92 (1.3)	29 (1.9)	19 (1.6)
Chinese Taipei	96 (1.1)	51 (2.5)	44 (2.9)	68 (2.5)	99 (0.6)	99 (0.7)	83 (1.9)	87 (1.8)	37 (3.0)	97 (0.9)	86 (1.9)	25 (2.0)
[2] Finland	96 (1.1)	66 (3.2)	18 (2.3)	61 (3.2)	100 (0.3)	78 (2.4)	94 (1.5)	74 (3.0)	22 (2.5)	83 (2.7)	46 (3.3)	12 (2.2)
[2] Hong Kong SAR	97 (1.0)	21 (2.8)	98 (1.0)	94 (1.7)	100 (0.5)	97 (1.2)	81 (2.7)	86 (2.6)	62 (3.7)	93 (1.8)	95 (1.5)	83 (2.4)
[4] Israel	80 (2.4)	70 (2.5)	50 (3.0)	64 (2.9)	87 (2.3)	93 (1.7)	82 (2.2)	85 (2.4)	36 (2.7)	58 (3.0)	12 (1.8)	8 (1.5)
[1] Italy	90 (2.0)	76 (2.5)	18 (2.2)	46 (2.7)	95 (1.2)	100 (0.2)	99 (0.5)	87 (1.7)	37 (2.9)	86 (2.0)	44 (3.1)	18 (2.3)
[1] Japan	99 (0.4)	59 (2.5)	60 (2.4)	62 (2.4)	97 (0.8)	97 (0.8)	85 (1.8)	78 (2.0)	31 (2.4)	58 (2.4)	44 (2.7)	24 (2.3)
[2] Lithuania	81 (2.8)	69 (3.5)	68 (3.6)	97 (1.2)	88 (2.4)	88 (2.2)	37 (3.1)	72 (3.4)	82 (2.6)	88 (2.1)	51 (3.4)	15 (2.2)
Moscow, Russian Federation	84 (1.6)	90 (1.4)	86 (1.8)	82 (1.8)	92 (1.4)	97 (0.9)	90 (1.7)	97 (1.0)	14 (1.7)	87 (1.8)	40 (2.4)	27 (2.2)
[2] Ontario Province, Canada	97 (0.9)	56 (3.2)	31 (3.0)	85 (2.2)	97 (0.9)	99 (0.7)	90 (1.8)	85 (2.2)	16 (2.2)	83 (2.4)	29 (2.8)	30 (2.9)
Russian Federation	68 (3.0)	79 (2.9)	78 (2.7)	78 (2.0)	82 (2.6)	94 (1.3)	77 (3.0)	91 (1.5)	26 (3.4)	79 (2.9)	23 (3.1)	15 (2.0)
Singapore	98 (1.2)	46 (3.9)	85 (3.1)	92 (2.2)	100 (0.0)	99 (1.0)	88 (2.6)	79 (3.4)	34 (4.0)	97 (1.4)	100 (0.0)	53 (4.2)
Slovak Republic	88 (1.7)	64 (2.4)	58 (2.6)	90 (1.6)	98 (0.8)	95 (1.3)	85 (2.0)	80 (2.1)	71 (2.5)	80 (2.3)	46 (2.6)	11 (1.7)
Slovenia	96 (1.1)	38 (3.0)	81 (2.0)	86 (2.1)	99 (0.6)	99 (0.5)	83 (2.2)	56 (3.0)	48 (2.9)	88 (1.7)	54 (2.8)	13 (1.9)
South Africa	54 (2.5)	37 (2.5)	22 (1.9)	31 (2.4)	49 (2.6)	51 (2.5)	44 (2.6)	47 (2.6)	21 (1.9)	40 (2.5)	11 (1.4)	7 (1.2)
[1] Thailand	49 (2.7)	90 (1.6)	66 (2.6)	93 (1.6)	86 (1.8)	96 (1.2)	93 (1.6)	91 (1.8)	59 (2.8)	81 (2.2)	37 (2.8)	15 (2.2)
[#] Denmark	89 (2.3)	17 (2.3)	48 (3.7)	91 (2.2)	93 (1.7)	63 (3.9)	73 (3.3)	81 (2.9)	24 (3.1)	92 (1.9)	31 (3.5)	44 (3.8)
[#] Estonia	79 (3.2)	69 (3.4)	80 (3.2)	97 (1.2)	97 (1.2)	88 (2.4)	86 (2.2)	85 (2.5)	34 (3.3)	82 (2.7)	44 (3.8)	3 (1.4)
[#] France	92 (1.8)	39 (3.5)	29 (3.3)	82 (2.8)	96 (1.4)	99 (0.5)	96 (1.4)	85 (2.3)	22 (3.5)	60 (3.3)	50 (3.2)	12 (2.5)
[#] Norway	93 (2.3)	26 (3.6)	36 (3.8)	64 (3.7)	88 (2.6)	94 (1.9)	81 (3.0)	76 (3.9)	27 (3.7)	75 (3.5)	60 (4.0)	40 (4.0)

Notes :

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

Table 4.18 Percentages (standard errors) of schools that had taken particular organizational actions

Education system	Re-allocate workload for collaborative planning	Re-allocate workload for technical support	Organizing demo-workshops	Review pedagogical approach of teachers	Monitor implementation of change	New teacher teams	Change class schedules	Incentive schemes	Teachers collaborate with external experts	New instructional methods in school newspaper	Parents involved in ICT-related activities
[2,3] Alberta Province, Canada	71 (3.5)	59 (3.5)	83 (2.6)	83 (3.0)	81 (3.3)	63 (3.7)	56 (4.4)	30 (3.3)	87 (3.1)	53 (4.2)	40 (4.0)
Catalonia, Spain	58 (2.6)	67 (2.6)	62 (2.6)	76 (2.3)	68 (2.8)	36 (2.7)	49 (3.1)	11 (1.7)	65 (2.7)	50 (3.2)	33 (2.6)
[1] Chile	81 (2.0)	79 (2.0)	75 (2.0)	94 (1.3)	88 (1.8)	60 (2.3)	61 (2.5)	32 (2.1)	72 (1.9)	53 (2.4)	57 (2.5)
Chinese Taipei	76 (2.2)	76 (2.3)	92 (1.6)	86 (1.7)	82 (2.3)	75 (2.5)	68 (2.4)	67 (2.4)	88 (1.7)	73 (2.3)	58 (2.6)
[2] Finland	47 (3.0)	50 (3.1)	38 (2.9)	52 (3.2)	43 (3.3)	30 (2.5)	45 (3.1)	9 (1.7)	68 (3.5)	23 (2.7)	23 (3.1)
[2] Hong Kong SAR	78 (2.9)	70 (3.4)	93 (1.9)	92 (1.7)	96 (1.3)	75 (3.0)	62 (3.3)	24 (3.0)	84 (2.5)	41 (3.4)	87 (2.2)
[4] Israel	57 (2.6)	58 (3.0)	74 (2.8)	91 (1.7)	82 (2.5)	72 (2.6)	62 (3.3)	30 (2.4)	77 (3.0)	51 (3.0)	37 (3.0)
[1] Italy	61 (2.7)	59 (2.8)	58 (2.9)	74 (2.7)	67 (2.7)	65 (3.1)	44 (2.7)	43 (2.7)	80 (2.3)	41 (3.1)	30 (2.5)
[1] Japan	45 (2.5)	33 (2.5)	27 (2.2)	69 (2.3)	47 (2.4)	19 (2.0)	25 (2.2)	0 (0.3)	40 (2.7)	25 (2.2)	6 (1.1)
[2] Lithuania	56 (3.7)	47 (3.1)	87 (2.7)	83 (2.6)	85 (2.5)	56 (3.8)	35 (3.6)	33 (3.7)	86 (2.7)	54 (3.4)	43 (3.7)
Moscow, Russian Federation	78 (2.1)	76 (2.5)	77 (2.1)	98 (0.7)	89 (1.7)	69 (2.4)	72 (2.4)	73 (2.3)	88 (1.6)	61 (2.5)	58 (2.3)
[2] Ontario Province, Canada	63 (3.1)	51 (3.1)	82 (2.1)	86 (2.1)	84 (2.2)	68 (2.7)	68 (3.3)	23 (2.8)	84 (1.9)	56 (3.1)	37 (3.0)
Russian Federation	62 (2.9)	59 (3.7)	72 (3.6)	96 (1.1)	77 (2.3)	52 (3.9)	56 (3.1)	55 (3.0)	75 (2.5)	36 (3.3)	35 (2.7)
Singapore	85 (3.1)	71 (3.9)	98 (1.2)	97 (1.5)	94 (2.0)	85 (2.8)	80 (3.4)	43 (4.3)	89 (2.8)	65 (3.5)	45 (4.3)
Slovak Republic	57 (2.8)	58 (3.0)	89 (1.7)	77 (2.4)	76 (2.2)	54 (2.7)	51 (3.0)	42 (2.6)	80 (2.2)	47 (2.8)	61 (2.7)
Slovenia	51 (2.8)	45 (2.6)	93 (1.5)	67 (2.6)	63 (2.5)	47 (2.7)	32 (2.5)	12 (2.0)	87 (1.7)	38 (2.9)	24 (2.4)
South Africa	72 (2.6)	61 (2.7)	46 (2.1)	71 (2.7)	77 (2.3)	63 (2.8)	63 (2.5)	30 (2.2)	82 (2.3)	38 (2.4)	28 (2.4)
[1] Thailand	89 (2.0)	90 (1.8)	75 (2.4)	87 (2.1)	87 (2.0)	68 (2.7)	84 (2.1)	84 (2.1)	90 (1.6)	58 (2.7)	48 (2.7)
[#] Denmark	76 (3.0)	56 (3.6)	67 (3.0)	63 (3.6)	76 (2.9)	63 (3.4)	43 (3.6)	52 (3.7)	54 (4.0)	50 (3.5)	34 (3.5)
[#] Estonia	43 (3.8)	45 (3.5)	75 (2.9)	84 (3.0)	89 (2.6)	44 (3.6)	65 (3.4)	36 (3.1)	65 (3.9)	15 (2.5)	40 (3.4)
[#] France	30 (3.0)	44 (3.8)	52 (3.4)	59 (3.8)	47 (3.8)	53 (3.9)	48 (3.5)	56 (3.9)	60 (3.4)	34 (3.1)	5 (1.4)
[#] Norway	80 (3.3)	56 (3.9)	46 (4.0)	84 (2.8)	82 (2.8)	61 (3.8)	69 (3.7)	69 (3.9)	52 (4.1)	27 (3.3)	41 (3.7)

Notes :

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

Table 4.19 Percentages (standard errors) of schools that had taken particular actions (monthly or weekly) regarding internal and external communication

Education system	Activities to develop common vision	Inform teachers ped. changes in school	Inform teachers ped. changes outside school	Consult teachers of desired ped. changes	Discuss what teachers want to achieve	Motivate teachers to assess own eductional practices	Encourge teachers assess practices against school goals
[2,3] Alberta Province, Canada	38 (3.9)	59 (2.9)	64 (3.4)	44 (3.9)	39 (3.7)	53 (4.0)	52 (3.8)
Catalonia, Spain	32 (2.3)	45 (2.8)	30 (2.4)	33 (2.9)	31 (2.5)	24 (2.3)	28 (2.7)
[1] Chile	73 (2.2)	83 (1.8)	63 (2.3)	70 (2.1)	78 (2.0)	82 (2.0)	78 (2.0)
Chinese Taipei	28 (2.4)	34 (2.6)	30 (2.7)	26 (2.0)	35 (2.4)	30 (2.4)	32 (2.4)
[2] Finland	9 (1.8)	26 (2.9)	22 (2.7)	20 (2.4)	23 (2.6)	20 (2.5)	17 (2.3)
[2] Hong Kong SAR	8 (1.9)	22 (3.2)	23 (3.0)	8 (2.1)	13 (2.1)	17 (2.4)	18 (2.6)
[4] Israel	37 (3.2)	55 (3.4)	40 (3.8)	49 (3.0)	42 (3.1)	36 (3.1)	36 (3.0)
[1] Italy	17 (2.3)	31 (2.8)	21 (2.4)	31 (2.7)	45 (3.0)	45 (3.0)	48 (3.0)
[1] Japan	17 (2.0)	7 (1.4)	18 (1.9)	18 (2.2)	17 (2.1)	7 (1.3)	26 (2.3)
[2] Lithuania	11 (2.2)	47 (3.5)	56 (3.5)	52 (3.9)	42 (3.7)	28 (3.4)	28 (3.6)
Moscow, Russian Federation	40 (2.2)	76 (2.0)	37 (2.7)	59 (2.8)	67 (2.5)	56 (2.5)	34 (2.3)
[2] Ontario Province, Canada	51 (3.0)	72 (2.6)	75 (2.7)	59 (2.9)	44 (3.1)	62 (3.3)	60 (3.1)
Russian Federation	26 (2.4)	65 (3.0)	37 (2.4)	41 (2.8)	58 (2.6)	43 (3.2)	29 (3.8)
Singapore	35 (4.1)	49 (3.9)	48 (3.9)	42 (4.0)	49 (3.8)	53 (3.8)	51 (3.9)
Slovak Republic	50 (2.7)	90 (1.7)	84 (2.1)	74 (2.5)	72 (2.4)	71 (2.4)	67 (2.6)
Slovenia	29 (2.5)	82 (2.4)	54 (2.8)	58 (2.6)	41 (2.8)	33 (2.5)	33 (2.3)
South Africa	31 (2.6)	55 (2.6)	53 (2.5)	49 (2.6)	57 (2.6)	61 (2.6)	62 (2.7)
[1] Thailand	43 (2.8)	57 (3.0)	67 (2.6)	65 (3.0)	68 (2.9)	70 (2.7)	68 (2.7)
[#] Denmark	24 (3.1)	56 (3.5)	38 (3.8)	45 (3.5)	35 (3.2)	40 (3.7)	46 (3.7)
[#] Estonia	15 (2.6)	46 (3.7)	34 (3.3)	30 (3.4)	31 (3.3)	23 (3.0)	29 (3.6)
[#] France	5 (1.9)	21 (3.1)	11 (2.3)	20 (3.0)	22 (3.1)	19 (2.6)	22 (2.6)
[#] Norway	22 (3.5)	47 (3.6)	30 (3.6)	39 (3.7)	39 (3.8)	31 (3.6)	20 (3.3)

Notes :

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

4.3 School principals' perceptions of the presence of lifelong learning pedagogy in schools: A comparison between 1998 and 2006

As explained in Chapter 1, SITES Module 1 was a school-level survey. According to Pelgrum (2001), the study's participants wanted to gain a better understanding of what was happening in schools with regard to

Table 4.19 Percentages (standard errors) of schools that had taken particular actions (monthly or weekly) regarding internal and external communication (Continued)

Education system	Discuss ped.changes with parents	Discuss teaching and learning with students	Teachers co-teach	Teachers cooperate with colleagues from other schools	Teachers discuss problems with colleagues	Teachers collaborate with teachers from other countries
[2,3] Alberta Province, Canada	33 (3.4)	38 (3.7)	78 (3.6)	90 (2.5)	98 (1.3)	24 (3.3)
Catalonia, Spain	8 (1.5)	7 (1.6)	94 (1.2)	91 (1.5)	97 (1.0)	88 (1.8)
[1] Chile	51 (2.7)	46 (2.5)	94 (1.2)	84 (1.7)	97 (0.9)	70 (2.2)
Chinese Taipei	14 (1.9)	20 (2.1)	98 (0.7)	97 (0.8)	100 (0.3)	89 (1.8)
[2] Finland	8 (1.8)	31 (2.6)	82 (2.6)	75 (3.0)	99 (0.7)	59 (3.5)
[2] Hong Kong SAR	5 (1.6)	7 (2.2)	92 (1.8)	87 (2.5)	99 (0.6)	71 (3.4)
[4] Israel	23 (2.8)	21 (2.9)	79 (2.6)	58 (3.0)	93 (1.5)	34 (2.6)
[1] Italy	25 (2.7)	14 (2.0)	96 (1.1)	97 (1.0)	99 (0.6)	93 (1.5)
[1] Japan	3 (0.9)	3 (0.9)	99 (0.6)	96 (0.9)	100 (0.0)	91 (1.4)
[2] Lithuania	9 (1.7)	39 (3.3)	82 (3.0)	98 (1.0)	100 (0.0)	66 (3.6)
Moscow, Russian Federation	20 (2.2)	42 (2.5)	99 (0.4)	92 (1.4)	100 (0.0)	69 (2.6)
[2] Ontario Province, Canada	43 (2.8)	42 (3.0)	91 (1.7)	94 (1.4)	98 (0.7)	27 (2.6)
Russian Federation	18 (2.5)	38 (3.6)	98 (0.8)	95 (1.0)	100 (0.2)	61 (3.2)
Singapore	10 (2.6)	21 (3.0)	97 (1.5)	93 (1.9)	100 (0.0)	71 (3.5)
Slovak Republic	34 (2.5)	56 (2.6)	45 (2.7)	93 (1.4)	100 (0.2)	75 (2.4)
Slovenia	15 (2.0)	27 (2.4)	92 (1.5)	94 (1.2)	98 (0.7)	71 (2.3)
South Africa	24 (2.2)	55 (2.5)	95 (1.1)	96 (1.1)	97 (0.8)	65 (2.7)
[1] Thailand	33 (2.9)	63 (3.0)	99 (0.4)	98 (0.8)	98 (0.7)	90 (1.9)
[#] Denmark	28 (3.2)	24 (3.4)	93 (1.9)	56 (3.3)	99 (0.8)	45 (3.3)
[#] Estonia	12 (2.5)	27 (3.5)	51 (3.7)	86 (2.7)	100 (0.0)	68 (3.6)
[#] France	12 (1.9)	3 (1.2)	91 (2.2)	91 (2.0)	98 (0.9)	91 (1.8)
[#] Norway	14 (2.9)	12 (2.6)	93 (2.1)	71 (3.6)	97 (1.5)	35 (4.2)

Notes :

[#] School participation rate after including replacement schools is below 70%

[1] School participation rate before including replacement schools is below 85%

[2] School participation rate after including replacement schools is below 85%

[3] Less than 70% of the school-level questionnaires in the participating schools were returned

[4] Nationally defined population covers less than 90% of the nationally desired population.

the pedagogical approaches being used within them. This objective was behind one of the questions addressed to school principals involved in SITES Module 1. Specifically, the question asked the principals to state the extent to which each of the following emerging pedagogical practices was present in their schools:

- Students develop abilities to undertake independent learning
- Students learn to search for, process, and present information

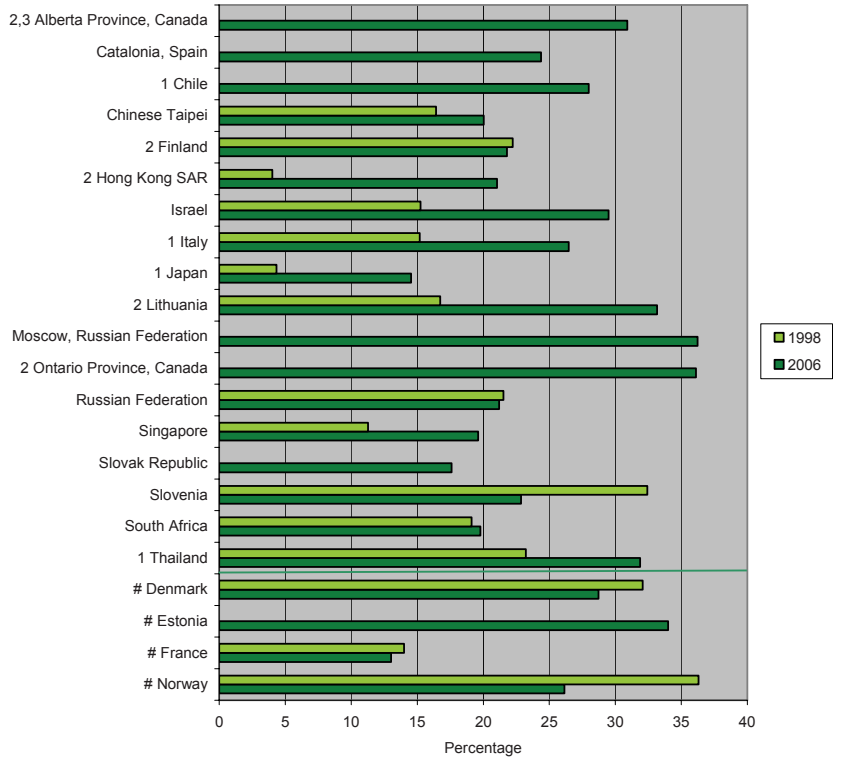
- Students are largely responsible for controlling their own learning progress
- Students learn and/or work during lessons at their own pace
- Students are involved in cooperative and/or project-based learning
- Students determine for themselves when to take a test.

This question was also asked of the school principals participating in SITES 2006. To allow comparison of the data from 1998 with that from 2006, the average percentage of school principals indicating these practices were present "a lot" was calculated for both data sets. The reliabilities of this indicator were satisfactory. Figure 4.6 presents the results. In 1998, Denmark, Norway, and Slovenia had relatively high percentages on this indicator, but by 2006, their percentages had decreased. Conversely, a number of education systems with relatively low percentages in 1998 showed a substantial increase over the eight years. Noteworthy are the results in Hong Kong, Japan, Israel, Italy, and Lithuania. The Danish colleagues who participated in SITES 2006 offered the following comment: "The fact that the presence of reform-oriented practice has decreased may have something to do with a change in educational policy in Denmark where a mostly reform-oriented policy is being replaced by an increased interest in tests and subject-related matters."

It is also useful to inspect changes across time in the statistics for the individual items that underlie the indicators in Figure 4.6. These item-level statistics are included in Table W4.5 (at http://www.sites2006.net/appendix), and a number of observations can be drawn from this information:

- The emphasis on information-handling increased in a substantial number of countries across the eight years (e.g., Chinese Taipei, +18%; Denmark, +20%; France, +11%; Hong Kong, +39%; Israel, +22%; Japan, +23%; and Singapore, +16%).
- Relatively noteworthy changes occurred in relation to individual items. These included, amongst others, independent learning (Denmark, -16%; France, -12%; Hong Kong, +19%; Israel, +27%; Norway, -27%; Russian Federation, 8%); learning at own pace (Denmark, -11%, Italy, +31%; Russian Federation, -18%; Slovenia, -24%); cooperative and project-based learning (Denmark: -12%; Hong Kong, +29%; Italy, +29%; Japan, +24; Russian Federation, +24%; Singapore, +24%); and students controlling their own learning process (Slovenia, -24%).

Figure 4.6 Percentages of school principals averaged across a set of items indicating "a lot" of presence of emerging pedagogy in SITES–M1 (1998) and SITES 2006 (2006)[1]



Notes:

See footnote at the end of this chapter for information about comparability; Missing bars = data not collected

[#]School participation rate after including replacement schools is below 70%

[1]School participation rate before including replacement schools is below 85%

[2]School participation rate after including replacement schools is below 85%

[3]Less than 70% of the school-level questionnaires in the participating schools were returned

[4]Nationally defined population covers less than 90% of the nationally desired population.

- No major changes were observed in Finland, but substantial increases for nearly all items showed up in Lithuania and Thailand. Most noteworthy in Thailand was the increased focus on learning at one's own pace (from 32% to 56%).

It appears, from this overview, that the most noteworthy change between 1998 and 2006 was the increase in pedagogical practices involving information-handling (i.e., searching for information,

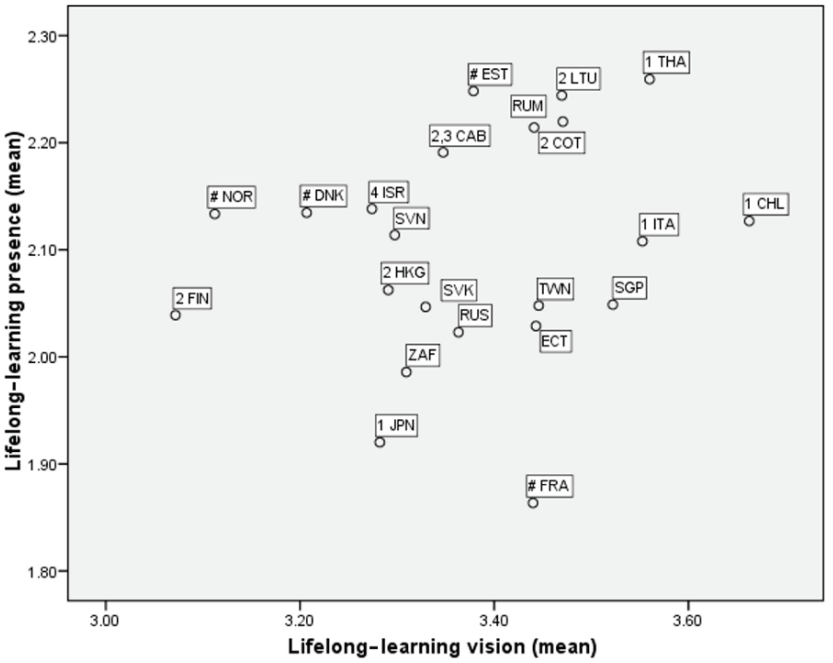
processing data, and presenting information). This change aligns with what might be expected given the increasing availability of the internet within the education systems. The picture is not so clear cut with respect to independent learning, however. This indicator showed an increase in some systems and a decline in others.

An interesting question arising from these results is whether the differences between education systems with regard to the vision that principals had of pedagogical-related lifelong learning ("lifelong-learning vision"; refer Table 4.1) were consistent with the principals' perception that these practices were actually occurring in their schools. The data presented in Figure 4.7 allowed examination of this issue. Here we can see that the positions of the education systems in terms of the scores (averaged across six items) for both indicators and that there is indeed, overall, some co-variation between the visions of the school principals and their perceptions of their existence in their schools. However, there are also a few interesting exceptions:

- In Norway, Finland, and Denmark, lifelong learning-pedagogical practices were more prevalent than we might have expected on the basis of the principals' visions. Assuming that practice usually follows vision, this finding prompts the question of whether, in these education systems, school managements were no longer so certain that student-centered pedagogical approaches are relevant.
- The opposite seems to be the case in France and Japan, where the school principals appear to have been somewhat more innovation-oriented relative to the practices actually taking place in the schools. Could this mean that the visions of these principals were ahead of those of the teachers?

But are principals good informants about what is happening in the classrooms in their schools? If the results from the principals produced the same pattern of differences between systems as did the results from the teachers, then we would have a basis for arguing that principals are good informants. A first exploration with regard to this matter was conducted by comparing the answers from the teachers with the perception of principals regarding the presence of lifelong-learning-oriented practices. Teachers reported how often students engaged in a number of such practices. For each teacher, the average score across these items was calculated (similar to the score calculation for the presence of lifelong-learning practices for principals).

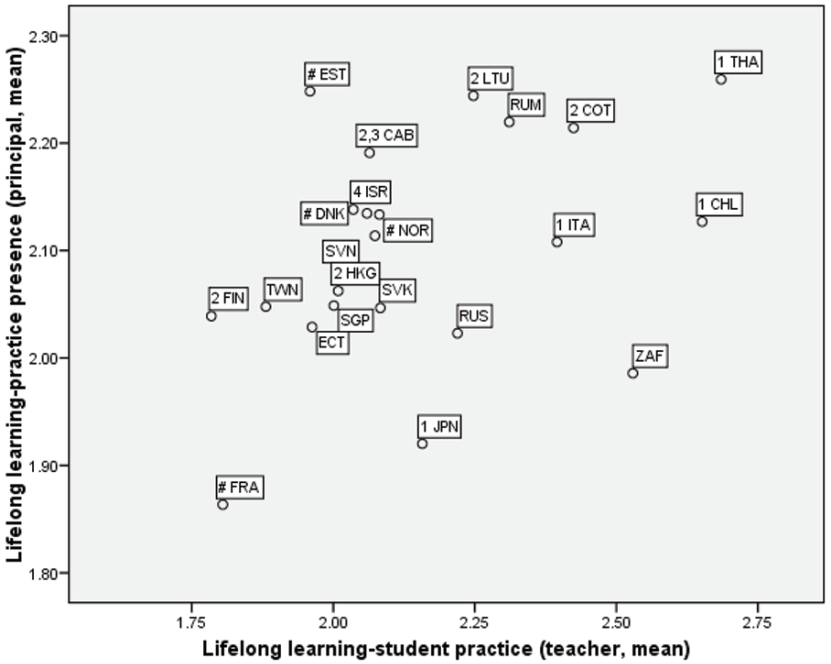
Figure 4.7 Mean score on indicators of the lifelong-learning vision of school principals and perceived presence of this pedagogical paradigm



Notes:
Response categories for lifelong-learning vision: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree; for lifelong learning presence: 1=not at all, 2= to some extent, 3= a lot
For country abbreviations, see Table 1.1
[#] School participation rate after including replacement schools is below 70%
[1] School participation rate before including replacement schools is below 85%
[2] School participation rate after including replacement schools is below 85%
[3] Less than 70% of the school-level questionnaires in the participating schools were returned
[4] Nationally defined population covers less than 90% of the nationally desired population.

The scatter diagram in Figure 4.8 indicates that, overall, these indicators converged at an aggregated level. Although the co-variation between both indicators stands out as a first overall impression of Figure 4.8, there are exceptions to the overall patterns, such as Estonia (EST), where school principals perceived relatively more lifelong-learning activities than teachers reported, versus Chile (CHL), Japan (JPN), and South Africa (ZAF), where the opposite is evident. The reasons behind these exceptions are not yet well understood and so need further investigation.

Figure 4.8 Mean score on indicators of presence of lifelong-learning-oriented practices (by school principals) and perceptions of students' engagement in these types of activities by teachers



Notes:
Response categories for lifelong-learning vision: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree; for lifelong learning presence: 1=not at all, 2= to some extent, 3= a lot
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4.4 Relationships between school-level conditions

This chapter has produced a set of snapshots of the teaching and learning contexts in schools with respect to ICT. Overall, we can discern a great deal of variation within and between education systems with regard to conditions in schools. The working hypothesis was that these factors would not only be conditional for teaching and learning, but that they would also be interdependent. The goal of this section, therefore, was to discern correlations among the following sets of school-level indicators:

- *Existence of lifelong-learning pedagogy in the school*: the percentage of school leaders reporting that lifelong learning activities were present a lot in their school
- *Vision on lifelong-learning pedagogy*: the extent to which school leaders encouraged teachers to provide opportunities to students to involve themselves in learning activities that foster lifelong-learning skills
- *Vision on connectedness*: the extent to which school leaders were encouraging teachers to take up opportunities to learn from outside experts or peers and to be involved in communication activities
- *Vision on ICT for lifelong learning*: the importance that school leaders ascribed to using ICT to foster the lifelong-learning skills of students
- *Training needs of principals*: the extent to which principals felt a need to acquire competencies in managing change (such as developing a common vision, motivating teachers, promoting cooperation between teachers, cooperating with other schools, etc.)
- *Training requirements for teachers*: the extent to which teachers were required to acquire knowledge and skills related to lifelong-learning pedagogy (such as developing real-life assignments, engaging in team-teaching, and learning how to integrate ICT into teaching and learning, etc.)
- *Hardware availability*: the student–computer ratio
- *Hardware connectedness*: the student–internet-computer ratio
- *Software*: the extent to which a range of software tools was available
- *Technical support*: the extent to which technical support was available to teachers utilizing lifelong-learning pedagogy
- *Pedagogical support*: the extent to which pedagogical support was available for teachers utilizing lifelong-learning pedagogy
- *Number of years experience with ICT*: the number of years that the schools had been using ICT for teaching and learning purposes for students at the targeted grade level.

It is important to emphasize that questions relating to these indicators pertain to conditions existing at the school level. Questions that cut across levels are considered in Chapter 8.

The correlation matrix displayed in Table 4.20 provides support for several claims:

- In systems where the presence of lifelong-learning pedagogical practices was high, school leaders tended to have higher training needs with regard to change management
- In education systems where the vision indicators for lifelong-learning and connectedness were high, schools had less experience with ICT than did systems where these scores were lower
- High correlations emerged between the infrastructure indicators. The negative correlations for student–computer ratio and student–internet-computer ratio with other variables can be interpreted positively in that education systems with schools with a high availability of computers are not only likely to have a high availability of software but also to have had relatively long experience in using ICT. In those systems where software availability was high, the training needs of principals and requirements for training of teachers tended to be lower. The pattern of correlations evident here seems to relate to the number of years of experience with ICT and strongly suggests that the time when training is most needed is during the start-up phase.

Table 4.20 Correlations between school-level indicators aggregated at the system level (including only those education systems which met the sampling standards)

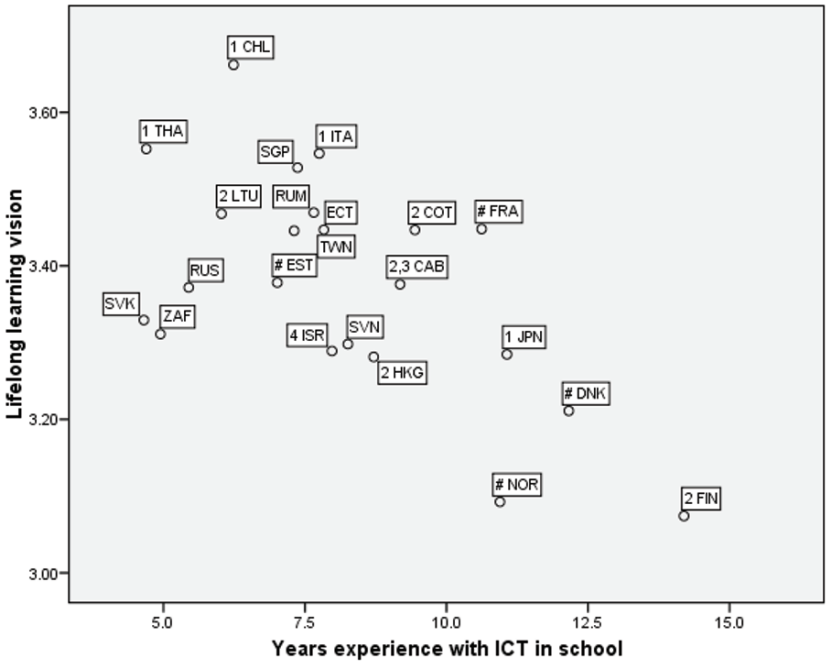
	Indicator	A	B	C	D	E	F	G	H	I	J	K
A	Existence lifelong learning pedgagogy											
B	Vision lifelong learning	.42										
C	Vision connectedness	-.03	.78*									
D	Vision ICT for lifelong learning	.45	.52*	.18								
E	Leadership development priorities	.50*	.72*	.52*	.58*							
F	Requirements for teacher training	.13	.18	.10	.10	.37						
G	Pedagogical support	.31	.35	.22	.47*	.08	-.07					
H	Technical support	.24	.42	.31	.69*	.36	-.13	.66*				
I	Student:computer ratio	-.14	.00	.19	-.37	.30	.32	-.32	-.35			
J	Student:Internet computer ratio	-.12	-.03	.11	-.42	.28	.38	-.37	-.42	.98*		
K	Software availability	-.06	-.09	-.16	.12	-.40	-.70*	.39	.42	-.74*	-.75*	
L	Years experience with ICT	-.03	-.47*	-.48*	-.13	-.58*	-.42	.00	-.15	-.66*	-.64*	.58*

* Significant at $p < 0.05$

The negative correlation between years of experience with ICT and other indicators in Table 4.20 (and further illustrated in Figure 4.9) is surprising when set against rhetoric on the need for educational reforms resulting from societal change. According to this rhetoric, ICT requires and facilitates the implementation of pedagogical changes that lead to more authentic, motivating, personalized, and autonomous learning. Many national policy plans make a direct link between reform initiatives

and improvements to schools' ICT-infrastructure (Plomp, Anderson, Law, & Quale, 2003). This is a time-consuming process, and many years can elapse before real change is evident. A first step toward adopting change is therefore the existence of a reform-oriented vision.

Figure 4.9 Mean score on indicators of lifelong-learning-pedagogical vision and the number of years education systems had experience with ICT



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With these notions in mind, we can hypothesize that the reform-oriented pedagogical vision of school leaders from education systems with relatively long experience with ICT will be more pronounced than the vision of leaders in systems with less experience. The data did not support this hypothesis, a situation that raises questions that need to be addressed through secondary analyses. One question of particular

interest in this regard is to what extent economic welfare underlies these simple co-variations. Could it be that the education systems that had recently introduced ICT were at the top of their reform ambitions, while the systems that had started much earlier were on their way back from the top?

4.5 Summary

This chapter examined data collected at the school level in SITES 2006 with respect to six conceptual domains: pedagogical practices, vision, infrastructure, staff development, support, and organization and structure. The following sub-sections summarize the major findings regarding each of these domains.

4.5.1 Pedagogical practices

The trend analyses regarding the presence of lifelong-learning practices as perceived by school principals suggest that the most noteworthy change between the SITES assessments of 1998 and 2006 was the increase in pedagogical practices involving information-handling (searching for information, processing data, and presenting information). This finding is not unexpected given the increasing availability of the internet. Overall, though, the picture in relation to the trend indicators is one of diversity, with some systems placing greater emphasis over time on autonomous learning of students, and other systems apparently placing less.

4.5.2 Vision of school leaders on pedagogy and ICT

The indicators of the vision of school leaders regarding pedagogy were operationalized in terms of the extent to which principals encouraged their teachers to adopt certain pedagogical approaches. The results showed that although principals were promoting all three visions (traditional, lifelong learning, and connectedness), they tended to give less support to connectedness than to the other two.

School leaders generally underscored the importance of using ICT for pedagogical approaches deemed important for lifelong learning. However, there were substantial differences among the education systems in this regard. In some systems, school leaders seemed, for example, relatively inactive in terms of trying to influence the

pedagogical practices of their teachers, while in other systems they tended to be much more active in this regard.

4.5.3 Infrastructure

In 1998, a substantial number of education systems still had schools without access to computers. However, by 2006, almost all schools in all participating education systems (except South Africa) were able to provide students at the target grade level with access to computers. Furthermore, in almost all education systems, schools that had access to computers also had access to the internet. Quite substantial increases in access to the internet took place in most education systems between 1998 and 2006.

Huge differences were observed between education systems in terms of ICT-infrastructural conditions. Some education systems had "very favorable" student–computer ratios (fewer than 5 students per computer) at more than half of their schools; other had "favorable" ratios (fewer than 10) at more than half of their schools. Some systems (in particular, and as expected, the developing economies) had yet to reach these levels, and in quite a few other systems, barely any schools had student–computer ratios of under 10. Very large ratio variations also existed within education systems, a finding that points to the existence of serious inequities between schools in terms of possibilities for students to access computers. This equity issue is no doubt an important one for policymakers to address in forthcoming years.

Although we might expect that students increasingly will bring their own equipment to schools, this practice was evident in only a few education systems in 2006. As to the equipment that respondents signaled were needed, smart boards and learning management systems tended to top the list. However—and again as expected—systems varied to a fair degree in terms of the priorities they placed on acquiring various items of ICT-infrastructure.

4.5.4 Pedagogical and technical support

A large degree of variation was observed between education systems with regard to indicators of the availability of pedagogical and technical support for teachers.

4.5.5 Staff development

In most education systems, hardly any or a minority of the schools required teachers to be trained in a variety of areas dealing with new pedagogy and ICT. The availability of courses also differed substantially across education systems. Overall, substantial numbers of school principals perceived a strong need to acquire competencies that would allow them to develop a common pedagogical vision among their teaching staff. However, with other aspects, the differences between education systems were quite remarkable.

4.5.6 Organization and structure

A re-allocation of workload to allow for collaborative planning had taken place in 80% or more of the schools in some education systems. The re-allocation was considerably less evident in the remaining systems. Reviewing the pedagogical approaches that teachers were using vis-à-vis ICT was a relatively popular practice in a majority of schools in most education systems, while implementing incentive schemes to encourage teachers to use ICT in lessons was occurring in some education systems, but barely in others. This same pattern was evident for involving parents in ICT-related pedagogy. Finally, differences between education systems were particularly apparent in regard to different actions relating to change management.

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[1] The sample of schools in SITES-M1 was drawn with a probability proportional to size (PPS) in order to allow for generalization of statistics to the population of students. SITES 2006 used a sampling design in which schools were randomly sampled from the population of schools in order to allow for statistical generalizations to the whole population of schools. Compensating for this difference required new calculations to be done for the SITES-M1 statistics. These used a sampling weight that corrected for the over-representation on large schools, so that the resulting sampling statistic could be generalized to the population of schools rather than to the population of students. It should also be noted that in SITES-M1, the sample of schools consisted of schools using ICT for instructional purposes at the targeted grade range. The SITES 2006 samples were focused on all schools. Hence, with regard to this aspect, the samples are comparable if both in 1998 and 2006 all targeted schools were using ICT. Figure 4.6 shows that in 1998 sizable numbers of schools in Israel, Italy, Lithuania, the Russian Federation, and Thailand were not yet using ICT, while in 2006, ICT-use was almost 100%. In South Africa, 18% of the schools were using ICT in 1998; by 2008, 38% were doing so. These countries should therefore be treated with caution during interpretation of the comparative statistics. Another issue regarding comparability is the sampling quality. As can be observed in all tables and figures containing 2006 school-level data, the sampling quality of school samples in Denmark, Estonia, France, and Norway was qualified by the IEA sampling referee as not satisfying the IEA sampling standards. In 1998, this was the case for Finland, Israel, Italy, the Russian Federation, and South Africa.