Chapter Seven

Satisfying Pedagogical Practices Using ICT

International Option

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This chapter describes the results of the international option that was included in SITES 2006. The international option, which was part of the teacher questionnaire, solicited responses from teachers on satisfying experiences in their pedagogical use of ICT. Twenty-one of the participating education systems took part in this option, the purpose of which was to follow up on earlier research into innovative pedagogical practices employing substantial use of ICT that was carried out as part of SITES Module 1 and SITES Module 2 (SITES-M1 and SITES-M2).

In this optional component, teachers who used ICT extensively were asked to provide a brief description of the one pedagogical practice involving ICT-use in the target class that they had found the most satisfying. With the description of this practice in mind, teachers were then asked to answer questions reflecting the contribution of ICT to changes in student outcomes and to changes in teaching practices. They were also asked if students or teachers were the main people to initiate several aspects of teaching and learning. The international option aimed to help answer the following research question for SITES 2006: *What ICT was used and how was it used in specific situations where ICT has been used relatively extensively within the pedagogical practice?*

N. Law et al. (eds.), Pedagogy and ICT Use in Schools around the World, 221–250.

7.1 Background to this research component

The international option of SITES 2006 served as a follow-up of SITES-M1 and SITES-M2. In SITES-M1, school principals were asked to describe the most satisfying example of ICT-use in their school. This process allowed collection of additional data needed to shed light on the emerging paradigm, that is, on the way technology facilitates realization of new goals for teaching and learning as emerging from the demands of an information society. The results of this part of SITES-M1 showed that many principals in 1998 were already able to provide examples of satisfying experiences with pedagogical use of computer-related technology. It was striking that, across education systems, a fairly large number of these satisfying experiences showed characteristics consistent with Pelgrum and Anderson's (1999) notion of the *emerging paradigm*.

SITES-M2 was an international study of innovative pedagogical practices that involved use of information and communication technology (ICT). A central focus of SITES-M2 was to find out, through in-depth comparative case studies of innovative exemplars of ICT-using pedagogical practice identified by national panels in the 28 participating systems, the following: the kind of characteristics found in these exemplars; whether there was evidence of paradigmatic changes in pedagogy; and the role played by ICT in such innovations. To submit cases for SITES-M2, the participating education systems had to follow a set of international criteria. These were:

1. The practice shows evidence of significant changes in the roles of teachers and of students, in curriculum goals, in assessment practices, and/or in educational materials
2. Technology plays a significant role in the practice and is a significant contributor to change
3. The practice is sustainable and transferable
4. The practice preferably is associated with positive student outcomes
5. The practice is innovative as locally defined.

For the latter criterion, national panels were appointed to formulate local criteria for innovativeness. (The key findings from this study are summarized in Chapter 1.)

7.2 Design of the international option

Voogt and Pelgrum (2003, 2005) argue that, for many education systems around the world, the implication of change toward the information society is the need for these systems to drastically change their curricula so that students develop competencies not addressed in traditional curricula. According to the European Commission, for instance, all citizens of the European Union should have opportunity to acquire so-called key skills, which include digital literacy and higher-order skills such as teamwork, problem-solving, and project management (European Commission, 2002).

These key skills are often referred to as lifelong-learning competencies. In elaborating on the concept of lifelong learning, education ministers of OECD countries (OECD, 2004) determined that lifelong learning covers all purposeful learning activity in a person's life. A major feature of this concept is developing the capacity of "learning to learn." Essentially, the lifelong-learning approach anticipates the need for societies and individuals to cope with the increased pace of globalization and technological change (OECD, 2004). These changes in society imply that teachers who prepare their students for the information society may aim at a different set of student outcomes than those commonly found in traditional schooling. The analysis of the SITES-M2 innovative practices by Voogt and Pelgrum (2003, 2005) showed that the students involved in the study had developed not only subject-matter knowledge but also information-handling, collaboration, and communication skills.

Developments in the learning sciences (see, for example, Bransford, Brown, & Cocking, 2000) show the benefits of learner-centered forms of instruction. Students are expected to be more actively involved in their own learning process, which asks for different teaching strategies and a change in the responsibilities that students and teachers have traditionally held within the learning process. These findings from research are consistent with the importance policymakers attach to "lifelong learning" and "learning-to-learn" competencies. Voogt (2003) proposed how pedagogical approaches consistent with the expectation and values of the information society might differ from those consistent with the expectations and values of the industrial society. Box 7.1 shows the characteristics of a pedagogical approach we might expect to find in an information society versus a pedagogical approach suited to an industrial society. The words "less/further" and "'more" used in Box 7.1 also indicate that education is today searching for a new balance between what can be termed "traditional" and "'emerging" pedagogies.

As noted above, the SITES-M2 findings emerged from case studies on innovative pedagogical practices using technology. The process of selecting the cases assured the inclusion of innovative pedagogy—as locally defined—but did not provide a representative picture of (innovative) ICT-supported pedagogical practices in schools. This situation was the main reason for exploring the extent to which extensive use of ICT was evident in a representative sample of teachers and schools (as in SITES 2006), and what this implied for ICT-supported pedagogical practices considered important in an information society.

Box 7.1 Overview of pedagogy in an industrial society versus an information society

Aspect	Less or fewer (pedagogy in an industrial society)	More (pedagogy in the information society)
Active	• Activities prescribed by teacher • Whole-class instruction • Variation in terms of activities • Program-determined pace	• Activities determined by learners • Small groups • Variety of activities • Learner-determined pace
Collaborative	• Individual • Homogeneous groups • Likelihood of everyone for him/herself	• Working in teams • Heterogeneous groups • Supporting one another
Creative	• Reproductive learning • Application of known solutions to problems	• Productive learning • Finding new solutions to problems
Integrative	• Linking between theory and practice • Separate subjects • Discipline-based • Individual teachers	• Integrating of theory and practice • Relationships/connections between subjects • Thematic • Teams of teachers
Evaluative	• Teacher-directed • Summative	• Student-directed • Diagnostic
Source: Voogt (2003, p. 222, adapted).		

Based on the above considerations, the SITES research team decided to focus the international option on pedagogical practices being used in the target class and involving extensive use of ICT. For this reason, teachers were asked (question T37) to indicate whether they used ICT "once a week or more in the target class" or whether they used ICT "extensively in the target class during a limited period during the year (e.g., in a project)." Teachers who did not comply with at least one characteristic were not asked to complete the international option; the remaining teachers were those teachers that the research team considered were using ICT extensively in the target class. They were asked to provide a brief description of the one pedagogical practice in which they had used ICT and which they considered the most satisfying. Box 7.2 provides the exact wording (question T38).

Box 7.2 Instruction for the description of most satisfying pedagogical practice

Please describe the one most satisfying pedagogical practice (that you applied in the target class) in this school year, in which you and/or your students used ICT extensively with specific content related to mathematics/science.
Please describe the pedagogical practice (e.g., a research project or a multimedia production), the ICT used (e.g., data-logging tools, spreadsheets or web search), and its content (e.g., curricular goals; topic) in a maximum of 20 words.

With the satisfying pedagogical practice in mind, the teachers were asked to answer three survey questions:

1. Has the use of ICT in this pedagogical practice contributed to changes in the following students' outcomes in the target class? (question T39)
2. Has the use of ICT in this pedagogical practice contributed to changes in the following aspects of your teaching of the target class? (question T40)
3. In this pedagogical practice, who was the main actor [person] in initiating the following aspects of teaching and learning? (question T41)

To design the survey questions the conceptual framework offered in Box 7.1 as well as the checklist (Kozma, 2003), developed and validated for the initial analysis of the SITES-M2 cases, has been used. Twenty-one education systems administered this part of the teacher questionnaire to the teachers participating in SITES 2006. The full questionnaire can be found in the online appendix (http://www.sites2006.net/appendix).

The results presented below are based on an analysis of the data collected from teachers who used ICT extensively and who responded with "yes" to the question "Do you use ICT in the teaching and learning activities of the target class?"

7.3 Some illustrative examples

Teachers used their native language when describing their satisfying pedagogical practice. A quick inspection of the descriptions of practices from teachers in English-speaking nations revealed that there were many differences with respect to information richness in the description provided. Some descriptions were brief and mentioned only the ICT applications used; other descriptions included more detail about content and pedagogy. Also, some of the longer descriptions were incomplete because of the limited space available in the online data collection. For this reason, analyzing all descriptions was not seen as a useful task. Instead, a decision was made to use a selection of the more informative descriptions as illustrative examples for this chapter.

Five mathematics and five science examples that were both long and complete were selected from the database of each participating system. The national research coordinators (NRCs) were then asked to translate these descriptions into English. Translations were received from all education systems, except Chinese Taipei. One mathematics example and one science example were then selected from each set of 10 examples per education system in order to illustrate the kinds of practices that teachers had in mind when responding to the survey questions of the international option. In most cases, the item chosen was the first long and informative example from the database. Box 7.3 (mathematics) and Box 7.4 (science) present examples of satisfying practices from the countries that participated in the international option.

Although it was not possible to analyze the examples the teachers provided, the general impression that emerged was consistent with the findings of SITES-M1 and SITES-M2, namely that students were engaging in information-processing, production activities, and communication, for which they were mostly using general-purpose software, the internet, and, on occasion, specific educational software. This broad use of general-purpose software and the internet in education is also consistent with findings from other studies (e.g., Becker, Rawitz, & Wong, 1999; van Kessel, Hulsen, & van der Neut, 2005). The examples provided also demonstrate that the teachers were using ICT creatively in their educational practice. According to Voogt (in press), the examples of satisfying ICT-use provided by teachers and principals in international studies like SITES-M1 and SITES-M2 show only limited use of all the possibilities IT offers, although use is being made of the basic possibilities—information retrieval and communication. The examples generated in SITES 2006 offer the same impression.

Box 7.3 Examples of most-satisfying pedagogical practices in mathematics from countries participating in the international option

Using Geometer's Sketchpad when teaching π (ratios of perimeter to diagonal in polygons and how π is the limit). Also Geometer's Sketchpad is extremely useful for angles and other geometry concepts. *Mathematics, Ontario, Canada*
Students had to do a price comparison of different floor coverings for their bedroom. They were to provide a scale drawing , a spreadsheet comparison and a graph comparison of cost. *Mathematics, Alberta,Canada*
Using a CDROM to work on Pythagorean Theorem in a game with students of Grade 8 who have great learning difficulties. *Mathematics, France*
Learning exponentiation formulas with the help of a computer program was nice especially with the less advanced students. It is important that there are tasks requiring different levels of knowledge and that there is access to the computer during the classes. *Mathematics, Finland*
Statistical work with spreadsheets, where we exchange data with another school in town via skolekom (the national school network). We make tables and diagrams for use when describing the town's traffic centers. *Mathematics, Denmark*
I have used the educational package "Live Math". ICT was also used for intermediate evaluation (tests), analysis of results and computer exercises. The level of training as well as the quality of student's knowledge has increased as a result. *Mathematics, Russian Federation*
Multimedia production in geometry. Identification and characteristics of angles, triangles and boxing rings ... exploring relations between parallel bars, rotation, symmetry, perimeters, areas and volumes. *Mathematics, Chile*
Exploration of Polygons. This is a cross-curriculum project with ICT. Students are expected to use PowerPoint to present information they find about properties, formulas, constructions, and applications of polygons *Mathematics, Hong Kong SAR*
Teaching the relative position of two circles or the relative position of a circle and a line by means of the "Cabri geometry" program. This program is easy to use and provides high visualization for better understanding and mastering a topic. *Mathematics, Slovak Republic*
In a project about the Pythagorean Theorem the students were required to enter websites that deal with Pythagoras and read and summarize them. They had to answer questions related to the theorem. In these websites, in fact, they learned independently what the Pythagorean Theorem is. *Mathematics, Israel*

Box 7.4 Examples of most-satisfying pedagogical practices in science from countries participating in the international option

Using ICT in teaching and learning about the digestive system. Students had to study diseases in the digestive system. They searched a variety of resources and did a survey among people in the community. They presented their findings via a website and produced a leaflet using PowerPoint. *Science, Thailand*
"Look into the past from the school laboratory" was an integrated project that combined history, chemistry and literature. Students used digital video cameras as well as the Internet to collect data. As a result the motivation (interest) to study these subjects has increased. *Science, Moscow, Russian Federation*
With the use of "Crocodile" software it is possible to demonstrate chemical reactions using various substances which are not used during lessons or which are not available. We aim at solidifying the pupils' knowledge about chemical ware and tools, metals and non-metals, changes in chemical reactions, etc. *Science, Lithuania*
A research project on climate change was carried out as a synthesis of the themes concerning atmosphere, hydrosphere, and the planet Earth. Students were organized in cooperative working groups to search and use internet data. Word-processing and multimedia materials have been used. *Science, Catalonia, Spain*
Sex education project in Science. Students searched for information on the internet about the consequences of sexual intercourse [and] made graphs with Excel about the probability of getting venereal deseases in genetics. *Science, Italy*
The learners were asked to do research from the library or an internet café about the population of the country. The response was overwhelming. Learners did the research although some did not have money to use the internet café. *Science, South Africa*
We participated in an environmental project "Baltic week," which linked 7 countries around the Baltic Sea. We used spreadsheets to gather and process data. *Science, Estonia*
Project work in Science on diseases. The pupils used the internet to gather information, used PowerPoint for presentations, and word-processing and digital photos for their written presentations. *Science, Norway*
Simulation software was used to show the diurnal motion of the sun and the stars on the screen in the class. It was more effective than showing still images. *Science, Japan*
Students prepared a project on a chosen topic (e.g., weather, air, a well-known physicist), they used the Internet to search for information and a text editor for writting the project. *Science, Slovenia*

7.4 Extent of use

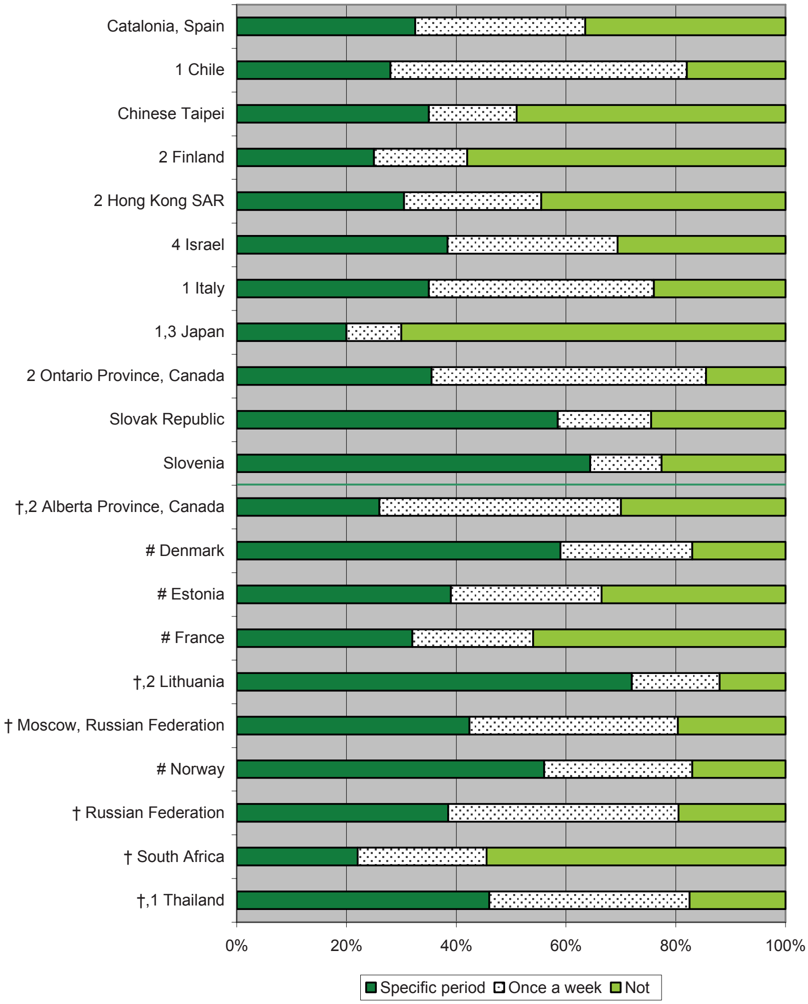
Figures 7.1a and 7.1b present the results per country of the percentage of mathematics teachers and the percentage of science teachers who were using ICT extensively. In six education systems (Catalonia, Chinese Taipei, France, Finland, Japan, and South Africa), one third or more of the science teachers were not using ICT in such an extensive manner. For mathematics teachers, this degree of use was the case in eight education systems (Catalonia, Chinese Taipei, Estonia, Finland, France, Hong Kong, Japan and South Africa). The use of ICT during a specific period (in a theme or a project) in the school year was common in most participating systems. Exceptions were Alberta, Chile, Hong Kong (for science only), Italy, Ontario, and the Russian Federation (for mathematics only). In these systems, the teachers were commonly using ICT on a weekly basis.

7.5 Changes in student outcomes

The participating teachers were asked whether the use of ICT in the pedagogical practice they had in mind contributed to changes in students' outcomes. Figures 7.2a and 7.2b present the results. It is worth mentioning that, according to the teachers, changes in student outcomes due to the use of ICT in the pedagogical practice were mostly seen to either increased or did not change.

Figures 7.2a and 7.2b show that more than half of both sets of teachers of the target grade reported an increase in student outcomes on all but one item for their specified pedagogical practice. In particular, students' learning motivation, ICT-skills, information-handling skills, and subject-matter knowledge increased according to more than 70% of both teacher populations. Although the examples provided by the teachers within the education systems often did not explicitly mention how ICT in the practice contributed to student outcomes, implicitly the examples show that ICT was contributing to students' learning motivation, students' ICT-skills, students' information-handling skills, and students' understanding of subject matter. It should be noted, however, that the achievement gap between students increased according to about 35% of the mathematics and the science teachers, and decreased according to 7% of the teachers. A closer analysis of the data is presented in Table 7.1. The table compares teachers who used ICT on a weekly basis with teachers who used ICT

Figure 7.1a Extent and modes of extensive use of ICT by mathematics teachers



Notes:

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

†International procedures for target-class selection were not followed in all schools

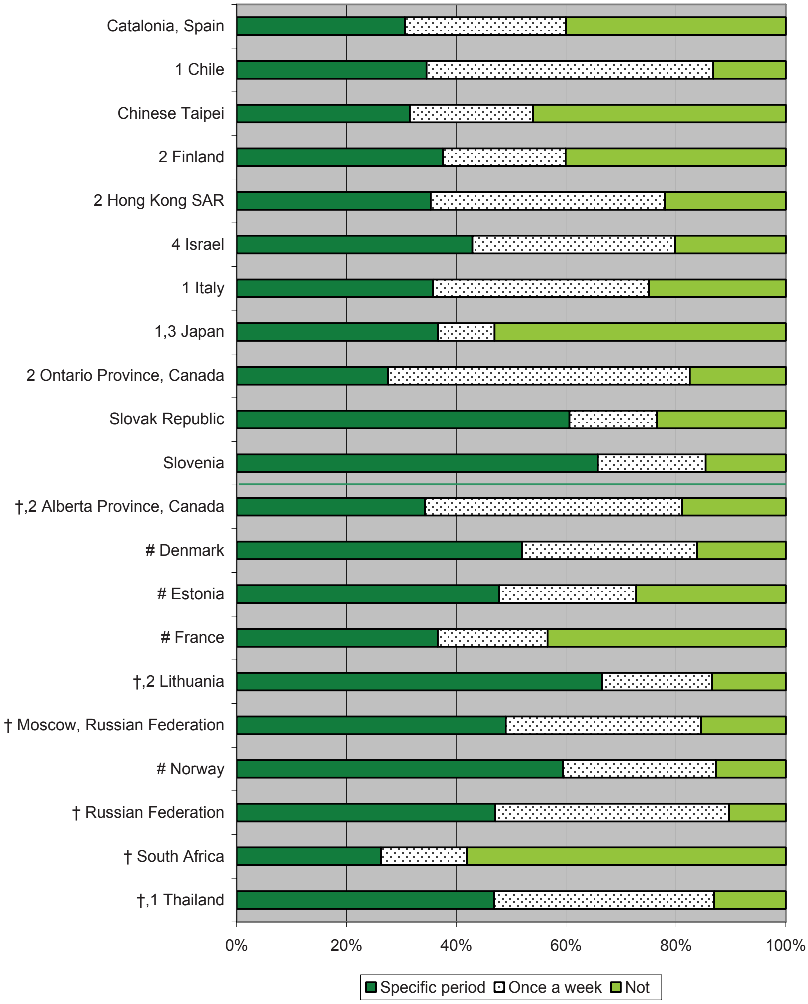
[1]School participation rate before including replacement schools is below 85%

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

[3]Teacher participation data were collected after survey administration

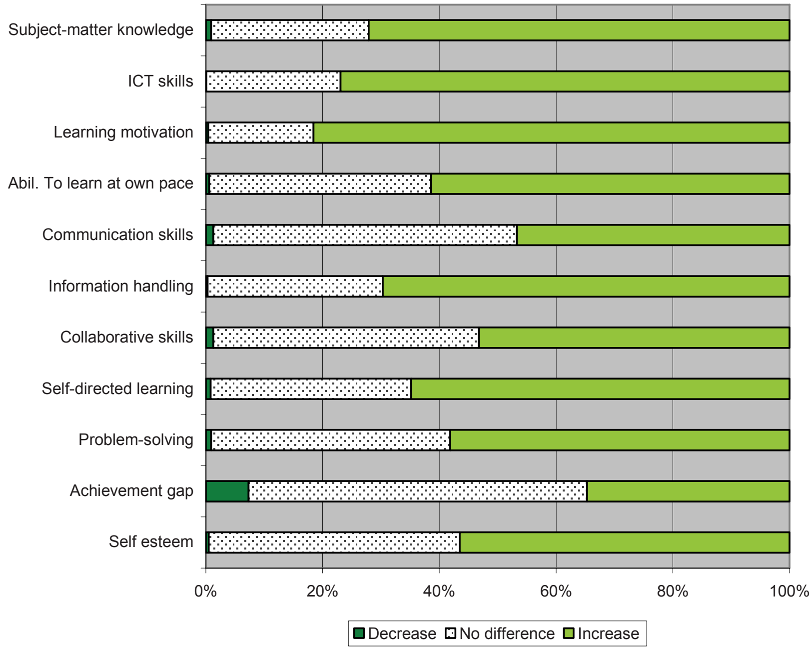
[4]Nationally defined population covers less than 90% of the nationally desired population.

Figure 7.1b Extent and modes of extensive use of ICT by science teachers



Notes:
#School participation rate after including replacement schools is below 70%
†International procedures for target-class selection were not followed in all schools
[1]School participation rate before including replacement schools is below 85%
[2]School participation rate after including replacement schools is below 85%
[3]Teacher participation data were collected after survey administration
[4]Nationally defined population covers less than 90% of the nationally desired population.

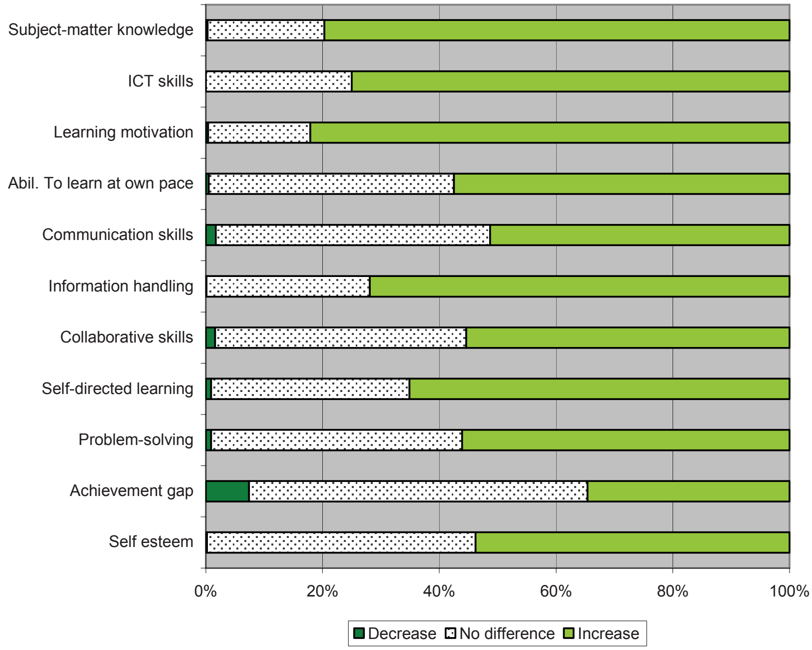
Figure 7.2a Mathematics teachers' perceptions of changes in student outcomes due to ICT



Notes:
#School participation rate after including replacement schools is below 70%
†International procedures for target-class selection were not followed in all schools
[1]School participation rate before including replacement schools is below 85%
[2]School participation rate after including replacement schools is below 85%
[3]Teacher participation data were collected after survey administration
[4]Nationally defined population covers less than 90% of the nationally desired population.

extensively during a specific period in the school year in Grade 8. More specifically, the results present the percentage of teachers who reported that the various student outcomes increased due to the use of ICT in the pedagogical practice. Compared to those teachers who used ICT during a specific period in the school year, the science teachers and the mathematics teachers who used ICT on a weekly basis appear to have been more convinced that students' ICT-skills, learning motivation, ability to learn at their own pace, communication skills, problem-solving skills, and self-esteem increased. In addition, the science teachers who used ICT on a weekly basis were more likely than their science colleagues who used ICT during a specific period of the school year to report an increase in information-handling skills. Mathematics teachers and science teachers

Figure 7.2b Science teachers' perceptions of changes in student outcomes due to ICT



Notes:

#School participation rate after including replacement schools is below 70%
†International procedures for target-class selection were not followed in all schools
[1]School participation rate before including replacement schools is below 85%
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[3]Teacher participation data were collected after survey administration
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who used ICT once a week were also more likely than their colleagues who used ICT during a specific period during the school year to report an increase in the achievement gap.

Table 7.2 compares the percentages of mathematics teachers who reported an increase in various kinds of student outcomes as a result of the particular example of satisfying pedagogical practice. Mathematics teachers in Japan (40%), Finland (50%), France (49%), Hong Kong (49%), South Africa (50%), and Norway (50%) reported a relatively low increase in student outcomes. Conversely, teachers from Thailand (89%), Chile (82%), Israel (74%), Italy (74%), and Moscow (74%) reported a high increase in student outcomes. Similar results were obtained from science teachers. Science teachers from Finland (49%), Hong Kong (47%), Japan

Table 7.1 Increase in aspects of student outcomes; comparison of perceptions of mathematics teachers and science teachers who were using ICT on a weekly basis and those who were using ICT during a specific period in the school year (% and (s.e.))

Education system	Mathematics teachers		Science teachers	
	Use once a week	Use specific period in school year	Use once a week	Use specific period in school year
Subject-matter knowledge	75 (2.1)	72 (1.6)	81 (1.5)	79 (1.2)
ICT-skills	80 (1.8)	76 (1.6)	77 (1.5)	73 (1.3)
Learning motivation	85 (1.7)	81 (1.7)	84 (1.3)	81 (1.2)
Ability learn own pace	64 (2.3)	59 (1.7)	59 (1.8)	57 (1.5)
Communication skills	52 (2.4)	44 (1.7)	55 (1.8)	48 (1.5)
Information-handling	71 (2.3)	69 (1.7)	75 (1.6)	70 (1.3)
Collaborative skills	55 (2.2)	53 (1.7)	57 (1.7)	55 (1.4)
Self-directed learning	64 (2.3)	66 (1.7)	66 (1.7)	64 (1.4)
Problem-solving	62 (2.4)	57 (1.7)	60 (1.8)	53 (1.4)
Achievement gap	39 (2.1)	32 (1.8)	37 (1.7)	33 (1.4)
Self-esteem	59 (2.3)	54 (1.5)	57 (1.6)	51 (1.3)

(41%), and Norway (51%) reported a relatively low increase, while science teachers from Chile (81%), Moscow (76%), and Thailand (88%) reported a relatively high increase. The corresponding percentages of science teachers who perceived increases in student outcomes can be found in the online appendix (http://www.sites2006.net/appendix).

7.6 Changes in teaching practices

Teachers were asked whether the use of ICT in the pedagogical practice they had specified had contributed to changes in their teaching practices in the target class; the results are presented in Figures 7.3a and 7.3b. A large majority of the mathematics and the science teachers reported that ICT in the pedagogical practice had led to an increase in variety of the learning resources (mathematics, 84%; science, 88%) and the learning activities (mathematics, 83%; science, 85%) they used. They also reported an increase in available content (mathematics, 71%; science 82%). In addition, more than half of the mathematics teachers and the science teachers observed that they were better able to adapt to the individual needs of their students (mathematics, 62%; science, 59%), and mentioned an increase in the quality of instruction (mathematics, 60%; science, 64%) and coaching (mathematics, 54%; science, 54%). Both populations of teachers also mentioned increased collaboration between students (mathematics, 54%; science, 55%), and reported an increase in self-confidence (mathematics, 56%; science, 53%). However, both the science teachers and the mathematics teachers reported that the time they needed for preparation had increased (mathematics, 59%; science, 56%).

It is noteworthy that about half of the mathematics teachers and of the science teachers did not see any difference in terms of their use or non-use of ICT in the time they needed to coach individual students, the time they needed to solve technical problems, and the time they needed for classroom management. Also, about half of both sets of teachers did not perceive a difference in regard to their normal routines and in the insight they had into their students' learning progress. In addition, about half of the teachers saw no difference in the quality of classroom discussion. While about one sixth of the mathematics teachers and the science teachers (15% and 16% respectively) reported that the amount of effort needed to motivate students had decreased relative to their usual teaching practice, about half mentioned an increase in the amount of effort needed to motivate students. This result may indicate that many teachers were making considerable effort to prepare practices that would motivate their students.

Table 7.3, which compares the teachers who were using ICT on a weekly basis with the teachers who were using ICT during a specific period during the school year, shows whether the various teaching practices increased as a result of ICT-use. Relatively large differences between the two groups in favor of those teachers using ICT on a weekly basis can be noticed with regard to quality of coaching, quality of instruction, insight into student progress, and time available for individual students. Moreover, science teachers using ICT on a weekly basis reported, more so than their science colleagues using ICT over a specific period during the school year, increases in communication with the world outside the school, the quality of classroom discussion, new learning content, possibility to adapt to students' individual needs, efforts to motivate students, and self-confidence. The science teachers who were using ICT on a weekly basis also noticed, unlike their colleagues using ICT less frequently, an increase in time needed to solve technical problems. Considerably more science teachers using ICT on a weekly basis than

Table 7.2 Mathematics teachers who perceived increases in student outcomes (% and (s.e.))

Education system	Subject-matter knowledge	ICT skills	Learning motivation	Abil. learn own pace	Communication skills	Information-handling	Collaborative skills	Self-directed learning	Problem-solving	Achievement gap	Self esteem
Catalonia, Spain	74 (3.5)	86 (3.1)	83 (3.6)	70 (4.3)	35 (4.5)	71 (4.0)	54 (3.8)	59 (4.0)	50 (4.4)	35 (4.2)	64 (3.9)
[1] Chile	90 (1.9)	90 (2.0)	94 (1.5)	83 (2.7)	74 (3.0)	91 (2.0)	79 (2.9)	80 (3.0)	79 (2.5)	51 (3.4)	89 (2.1)
Chinese Taipei	79 (3.5)	76 (3.7)	88 (2.5)	59 (4.2)	42 (4.1)	73 (4.2)	60 (4.4)	75 (3.7)	70 (3.8)	52 (3.6)	49 (4.3)
[2] Finland	50 (5.1)	63 (5.4)	72 (4.9)	61 (5.0)	39 (5.2)	61 (5.1)	32 (5.0)	62 (4.9)	46 (4.9)	13 (3.3)	47 (5.2)
[2] Hong Kong, SAR	76 (3.2)	51 (3.4)	80 (2.4)	43 (3.3)	35 (3.5)	54 (3.2)	34 (3.6)	48 (3.6)	57 (3.1)	29 (3.0)	32 (3.0)
[4] Israel	89 (3.0)	80 (4.1)	84 (3.8)	80 (3.7)	72 (4.2)	81 (4.0)	73 (4.2)	82 (3.7)	73 (5.0)	31 (4.0)	64 (4.7)
[1] Italy	83 (2.3)	91 (1.7)	90 (2.1)	68 (3.1)	58 (3.0)	78 (2.4)	77 (2.6)	65 (3.1)	62 (3.1)	52 (3.6)	85 (2.3)
[1, 3] Japan	55 (8.7)	53 (8.2)	65 (8.3)	43 (7.2)	23 (7.6)	37 (8.2)	20 (6.6)	55 (8.2)	43 (7.3)	35 (8.1)	14 (6.1)
[2] Ontario Province, Canada	73 (3.0)	87 (2.1)	77 (2.7)	62 (3.0)	50 (3.2)	69 (3.1)	43 (3.3)	61 (3.4)	58 (3.5)	28 (3.0)	57 (3.5)
Slovak Republic	62 (3.5)	87 (2.7)	70 (3.7)	46 (3.6)	46 (3.5)	80 (3.1)	57 (3.5)	56 (3.7)	55 (3.6)	17 (2.9)	62 (3.6)
Slovenia	60 (3.5)	84 (2.8)	91 (2.2)	61 (3.4)	40 (3.3)	74 (3.0)	55 (3.4)	69 (3.8)	49 (3.8)	38 (3.6)	55 (3.4)
[†, 2] Alberta Province, Canada	71 (4.0)	79 (3.2)	69 (4.6)	51 (4.4)	47 (4.3)	65 (3.8)	43 (4.4)	60 (4.2)	54 (4.6)	28 (3.6)	46 (4.3)
[#] Denmark	70 (3.5)	83 (2.8)	76 (3.1)	60 (3.5)	43 (3.6)	60 (3.7)	24 (3.1)	41 (3.3)	43 (3.9)	36 (3.6)	50 (3.6)
[#] Estonia	75 (5.6)	74 (5.8)	74 (5.5)	55 (6.6)	36 (6.4)	66 (6.4)	61 (6.6)	69 (5.8)	51 (6.5)	45 (6.3)	51 (6.7)
[#] France	51 (5.6)	70 (5.1)	80 (3.6)	52 (6.1)	30 (4.9)	46 (4.9)	44 (4.9)	42 (5.9)	38 (6.1)	28 (5.1)	58 (5.9)
[†, 2] Lithuania	69 (3.7)	96 (1.2)	77 (3.0)	63 (3.9)	66 (3.6)	88 (2.4)	75 (2.8)	75 (3.2)	60 (3.7)	43 (3.5)	50 (4.0)
[†] Moscow, Russian Federation	83 (2.8)	78 (2.8)	89 (2.5)	68 (3.6)	65 (3.5)	92 (2.0)	70 (3.5)	88 (2.3)	72 (3.6)	46 (3.8)	67 (3.4)
[#] Norway	52 (3.6)	96 (1.4)	80 (2.7)	30 (3.4)	48 (3.7)	71 (3.0)	24 (3.6)	38 (4.0)	32 (3.4)	32 (3.0)	42 (4.0)
[†] Russian Federation	72 (5.1)	74 (4.8)	80 (2.6)	62 (5.2)	57 (4.3)	87 (2.6)	65 (4.5)	80 (3.3)	64 (5.0)	50 (3.7)	58 (4.7)
[†] South Africa	56 (8.4)	46 (7.4)	55 (8.0)	53 (8.0)	62 (8.2)	51 (8.7)	37 (8.7)	38 (8.2)	61 (8.7)	40 (9.2)	56 (8.4)
[†, 1] Thailand	81 (2.9)	95 (1.8)	98 (1.0)	94 (1.6)	84 (3.1)	90 (2.4)	83 (3.2)	97 (1.0)	88 (2.5)	81 (3.3)	83 (3.3)

Notes: Value labels for the response categories: 1=never, 2=sometimes, 3=often, 4=nearly always

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

[†] International procedures for target-class selection were not followed in all schools

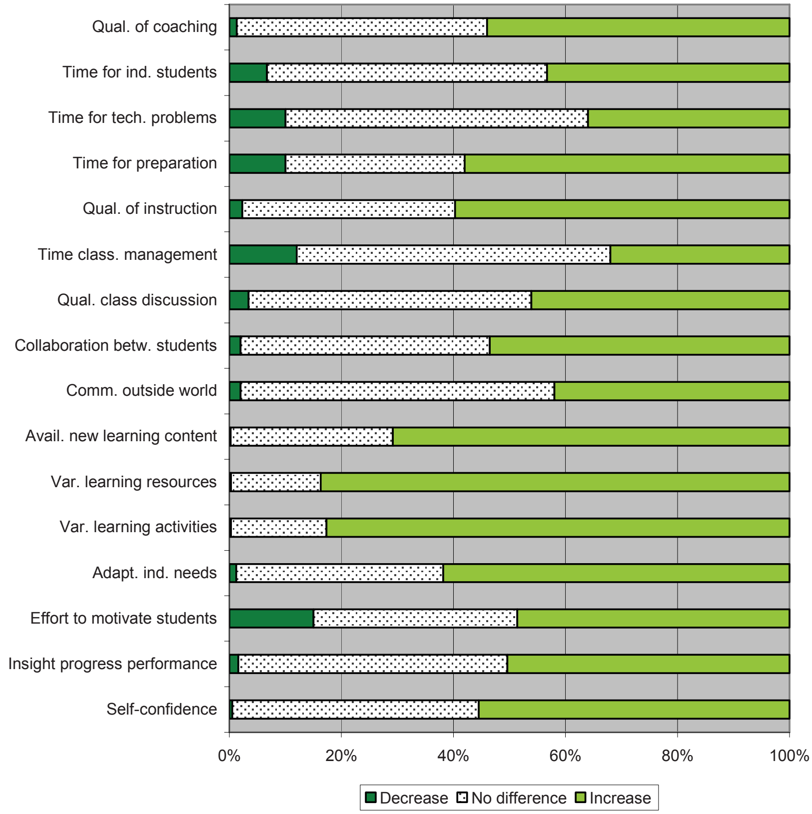
[1] School participation rate before including replacement schools is below 85%

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

[3] Teacher participation data were collected after survey administration

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

Figure 7.3a Mathematics teachers' perceptions of changes in teaching practices due to ICT use in the specified pedagogical activity

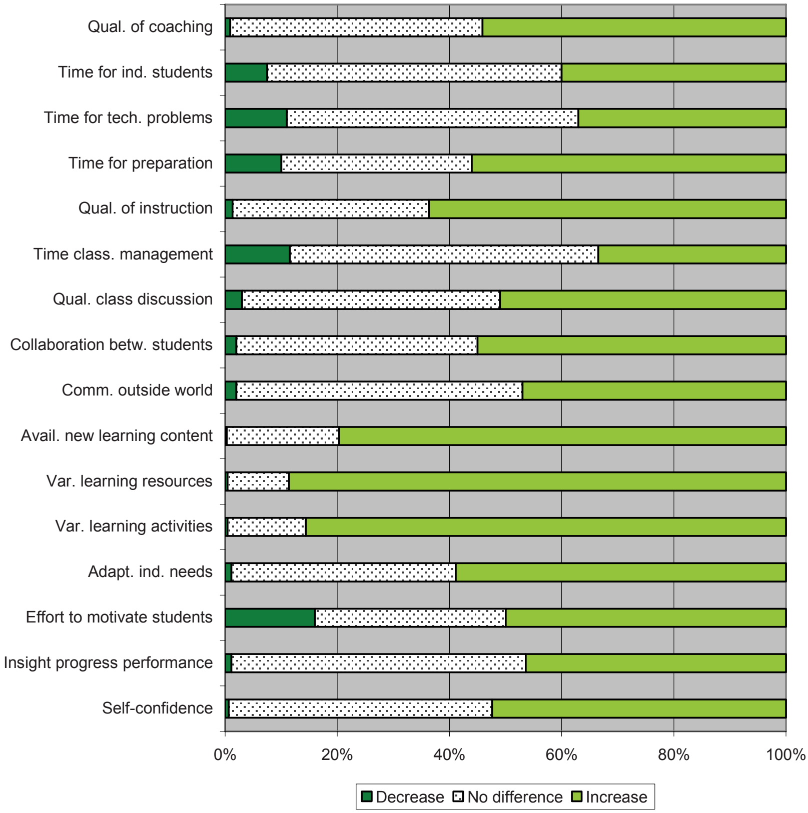


Notes:
#School participation rate after including replacement schools is below 70%
†International procedures for target-class selection were not followed in all schools
[1]School participation rate before including replacement schools is below 85%
[2]School participation rate after including replacement schools is below 85%
[3]Teacher participation data were collected after survey administration
[4]Nationally defined population covers less than 90% of the nationally desired population.

science colleagues using ICT during a specific period of the school year reported an increase in the variety of learning activities. For mathematics teachers, the trend seemed to be the reverse: more of the mathematics teachers using ICT during a specific period of the school year than colleagues using ICT weekly reported an increase in the variety of learning activities.

Table 7.4 presents, per country, how the teachers perceived ICT (as used in their specified pedagogical practices) had changed their teaching practices. Compared to their colleagues in the other education systems, relatively few teachers from Denmark, Finland, Japan, and Norway reported an increased use of various aspects of their teaching practice. Contrary to this, relatively large numbers of teachers from Chile, Moscow, and Thailand reported an increase in various aspects of their teaching practice as a result of ICT-use. Similar results were evident for science teachers, with relatively few from Denmark, Finland, Japan, and Norway reporting increased use, and a good number from Chile and Thailand

Figure 7.3b Science teachers' perceptions of changes in teaching practices due to ICT use in the specified pedagogical activity



Notes:
#School participation rate after including replacement schools is below 70%
†International procedures for target-class selection were not followed in all schools
1School participation rate before including replacement schools is below 85%
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3Teacher participation data were collected after survey administration
4Nationally defined population covers less than 90% of the nationally desired population.

Table 7.3 Increase in aspects of teaching; comparison of perceptions of mathematics and science teachers who were using ICT on a weekly basis and those teachers using ICT during a specific period of the school year (% and (s.e.))

Change in teaching practice	Mathematics teachers		Science teachers	
	Use once a week	Use specific period in school year	Use once a week	Use specific period in school year
Qual. of coaching	59 (2.3)	51 (1.7)	61 (1.7)	51 (1.4)
Time for ind. students	47 (2.3)	41 (1.9)	45 (1.9)	36 (1.5)
Time for tech. problems	38 (2.3)	35 (1.7)	43 (1.8)	34 (1.5)
Time for preparation	58 (2.4)	59 (1.7)	57 (1.8)	56 (1.5)
Qual. of instruction	63 (2.2)	58 (1.8)	70 (1.8)	61 (1.4)
Time class. management	34 (2.2)	31 (1.6)	35 (1.6)	32 (1.4)
Qual. class discussion	48 (2.3)	46 (1.7)	56 (1.7)	48 (1.3)
Collaboration betw. students	55 (2.4)	53 (1.5)	55 (1.5)	55 (1.4)
Comm. outside world	43 (2.2)	43 (1.7)	50 (1.5)	45 (1.4)
Avail. new learning content	75 (2.2)	71 (1.6)	83 (1.2)	78 (1.2)
Var. learning resources	83 (2.0)	85 (1.4)	90 (0.9)	88 (1.0)
Var. learning activities	81 (2.1)	86 (1.3)	88 (1.2)	84 (1.1)
Adapt. ind. needs	63 (2.4)	61 (1.8)	61 (1.7)	57 (1.5)
Effort to motivate students	49 (2.3)	48 (1.6)	52 (1.7)	48 (1.4)
Insight progress performance	53 (2.3)	47 (2.0)	51 (1.8)	43 (1.4)
Self-confidence	57 (2.4)	54 (1.7)	57 (1.8)	51 (1.4)

reporting increased use. The online appendix provides detailed information for each country regarding science teachers' perceptions of changes in teaching practice (http://www.sites2006.net/appendix).

7.7 Person initiating teaching and learning aspects

The participating teachers were asked to identify who was the main initiator of aspects of teaching and learning in the pedagogical practice that they each had in mind. The results in Figures 7.4a and 7.4b clearly show that, for all aspects of teaching and learning, most of the Grade 8 mathematics teachers and the Grade 8 science teachers reported themselves as the main initiators of teaching and learning in the pedagogical practice they had each specified.

However, a relatively large number of teachers—albeit somewhat under half of each population—said that their Grade 8 students initiated the organization of group work (43% of mathematics teachers and 45% of science teachers) and took the initiative to demonstrate their achievement (42% of mathematics teachers and 42% of science teachers). For all other aspects of teaching and learning, less than 30% of both sets of teachers reported that their students took the initiative.

Table 7.5 compares teachers who were using ICT on a weekly basis with colleagues who were using ICT in a specific period of the school year in terms of which person they thought took the initiative in relation to various aspects of teaching and learning. The table presents the percentage of teachers who reported students as the initiators. Although it is evident from the table that the differences between the two groups were small, the results nonetheless suggest that those mathematics teachers and science teachers who were more inclined to use ICT extensively during a specific period in the school year were the group most likely to report that students took the initiative in organizing group work. In addition, this same set of teachers was more likely than the other group to report that their students took the initiative to demonstrate their achievement.

Table 7.6 presents the results of the "initiator" comparison between mathematics teachers who were weekly users of ICT and those who were specific-period-of time users. (Corresponding information for the science teachers is reported in the online appendix http://www.sites2006.net/appendix). The table shows, per system, the percentage of teachers who reported that students were the initiators. As with the earlier comparisons in this chapter, the results again provide a varied picture.

A closer look at these data was made possible by grouping the different aspects of teaching and learning into four broad curriculum categories: content and goals of learning; organization of time and location; organization of the learning process; and assessment. Figures 7.5

Table 7.4 Mathematics teachers' perceptions of changes (increase) in teaching practices (% and (s.e.))

	Education system	Qual. of coaching	Time for ind. students	Time for tech. problems	Time for prepa-ration	Qual. of instruction	Time class. manage-ment	Qual. class discussion	Collabora-tion betw. students	Comm. outside world	Avail. new learning content	Var. learning resources	Var. learning activities	Adapt. ind. needs	Effort to motivate students	Insight progress perfor-mance	Self-confidence
	Catalonia, Spain	57 (4.3)	40 (4.7)	34 (4.4)	59 (4.5)	44 (4.2)	33 (4.2)	40 (4.2)	55 (4.4)	45 (4.6)	65 (3.8)	88 (2.8)	88 (2.5)	65 (4.3)	27 (3.6)	43 (5.0)	58 (4.7)
1	Chile	81 (2.9)	60 (3.0)	37 (3.9)	45 (3.3)	73 (3.2)	49 (3.8)	68 (3.6)	82 (2.8)	62 (3.7)	90 (1.9)	93 (1.6)	93 (1.7)	76 (3.0)	59 (3.9)	75 (3.2)	84 (2.6)
	Chinese Taipei	48 (4.3)	39 (4.1)	50 (4.2)	78 (3.9)	67 (4.3)	34 (4.1)	59 (4.0)	57 (4.2)	40 (4.3)	84 (3.4)	89 (2.6)	86 (3.0)	62 (4.7)	80 (3.4)	57 (4.2)	64 (4.0)
2	Finland	34 (5.5)	39 (5.2)	30 (4.9)	55 (5.6)	34 (5.2)	17 (4.4)	30 (4.5)	23 (4.2)	22 (4.4)	60 (5.6)	75 (5.1)	80 (4.5)	48 (5.8)	23 (4.4)	32 (4.7)	41 (5.2)
2	Hong Kong SAR	25 (3.2)	27 (2.6)	41 (3.5)	73 (3.3)	73 (2.7)	43 (3.5)	52 (3.4)	37 (3.4)	28 (3.1)	60 (3.5)	77 (2.9)	78 (2.8)	43 (3.1)	62 (3.4)	48 (3.7)	38 (3.3)
4	Israel	78 (4.7)	54 (5.3)	45 (5.0)	69 (5.1)	81 (3.9)	42 (5.0)	65 (4.2)	69 (4.5)	64 (5.0)	76 (4.2)	81 (4.3)	85 (3.4)	80 (3.7)	55 (4.5)	64 (5.3)	63 (4.4)
1	Italy	79 (2.5)	44 (3.3)	36 (3.2)	45 (3.2)	86 (1.8)	34 (2.9)	52 (3.6)	79 (2.3)	60 (2.8)	91 (1.7)	93 (1.4)	91 (1.7)	70 (2.9)	72 (2.9)	67 (3.1)	70 (3.2)
1, 3	Japan	28 (6.8)	49 (9.1)	26 (7.1)	66 (7.5)	26 (7.4)	08 (4.8)	09 (4.8)	17 (7.3)	20 (6.9)	48 (7.5)	71 (7.8)	63 (8.1)	51 (8.5)	37 (6.9)	37 (8.5)	29 (7.4)
2	Ontario Province, Canada	40 (3.0)	32 (3.1)	41 (3.5)	52 (3.2)	62 (3.6)	14 (2.4)	37 (3.1)	52 (3.3)	40 (3.4)	80 (2.7)	86 (2.4)	82 (2.2)	59 (3.2)	22 (2.9)	44 (3.4)	50 (3.7)
	Slovak Republic	49 (3.7)	44 (4.3)	37 (3.9)	62 (3.9)	58 (4.1)	49 (3.8)	55 (3.2)	64 (3.7)	55 (3.2)	72 (3.4)	85 (3.0)	84 (3.2)	61 (3.8)	42 (3.6)	45 (3.5)	62 (3.5)
	Slovenia	76 (3.1)	47 (4.0)	22 (3.0)	41 (3.7)	57 (3.7)	34 (3.6)	39 (3.4)	54 (3.4)	30 (3.0)	57 (3.7)	87 (2.5)	83 (2.5)	65 (3.3)	53 (3.4)	40 (3.9)	52 (3.6)
†, 2	Alberta Province, Canada	44 (4.4)	39 (4.4)	40 (4.4)	54 (4.1)	62 (4.1)	20 (4.0)	37 (4.1)	41 (4.4)	42 (4.3)	70 (3.9)	85 (2.9)	89 (2.5)	58 (4.0)	29 (4.3)	44 (4.3)	46 (3.9)
#	Denmark	26 (2.9)	23 (3.0)	42 (4.0)	47 (3.5)	32 (3.4)	15 (2.6)	23 (3.2)	32 (3.7)	30 (3.0)	77 (2.8)	53 (3.4)	57 (3.1)	53 (3.5)	20 (2.7)	30 (3.2)	39 (3.4)
#	Estonia	64 (6.4)	39 (6.7)	51 (6.3)	80 (5.3)	60 (6.4)	26 (5.7)	39 (6.4)	63 (6.1)	50 (6.3)	86 (4.8)	85 (4.8)	88 (4.5)	59 (7.2)	43 (6.7)	57 (6.8)	62 (7.1)
#	France	57 (5.1)	46 (5.5)	45 (5.4)	70 (5.0)	44 (5.6)	33 (4.4)	44 (4.3)	48 (5.8)	15 (3.9)	67 (4.9)	84 (3.3)	88 (2.7)	54 (5.8)	29 (4.5)	36 (5.5)	52 (5.3)
†, 2	Lithuania	70 (3.4)	47 (4.0)	48 (3.9)	75 (3.9)	85 (2.8)	68 (3.1)	49 (4.1)	74 (3.0)	78 (3.1)	86 (2.7)	98 (1.0)	87 (2.4)	58 (3.3)	75 (3.4)	41 (3.8)	70 (3.5)
†	Moscow, Russian Federation	84 (2.6)	58 (3.1)	42 (3.7)	53 (4.1)	60 (3.9)	33 (3.5)	64 (3.7)	74 (3.2)	76 (3.1)	89 (2.3)	94 (1.8)	93 (1.7)	78 (3.0)	11 (2.4)	57 (3.7)	74 (2.9)
#	Norway	26 (3.8)	24 (3.1)	26 (3.3)	39 (3.9)	59 (3.9)	35 (3.9)	14 (2.9)	29 (3.8)	30 (3.7)	73 (3.6)	73 (3.5)	84 (2.6)	55 (3.9)	33 (3.3)	25 (3.6)	34 (4.0)
†	Russian Federation	76 (3.6)	55 (4.5)	38 (4.3)	59 (4.1)	61 (5.3)	20 (4.3)	56 (5.2)	61 (4.2)	72 (3.5)	83 (3.3)	82 (2.6)	89 (2.1)	66 (4.8)	13 (4.2)	53 (4.4)	78 (3.9)
†	South Africa	62 (8.8)	47 (8.7)	41 (9.0)	50 (8.6)	62 (8.9)	49 (8.6)	56 (8.3)	49 (9.0)	38 (8.7)	55 (8.9)	42 (8.8)	49 (9.1)	45 (8.9)	49 (8.5)	51 (8.6)	61 (8.9)
†, 1	Thailand	88 (2.4)	63 (4.1)	60 (4.4)	60 (4.2)	93 (2.2)	52 (4.5)	75 (3.9)	91 (2.2)	86 (2.9)	94 (2.0)	95 (1.5)	96 (1.3)	87 (2.7)	76 (3.3)	86 (2.9)	91 (2.1)

Notes: Value labels for the response categories: 1=never, 2=sometimes, 3=often, 4=nearly always

School participation rate after including replacement schools is below 70%

† International procedures for target-class selection was not followed in all schools

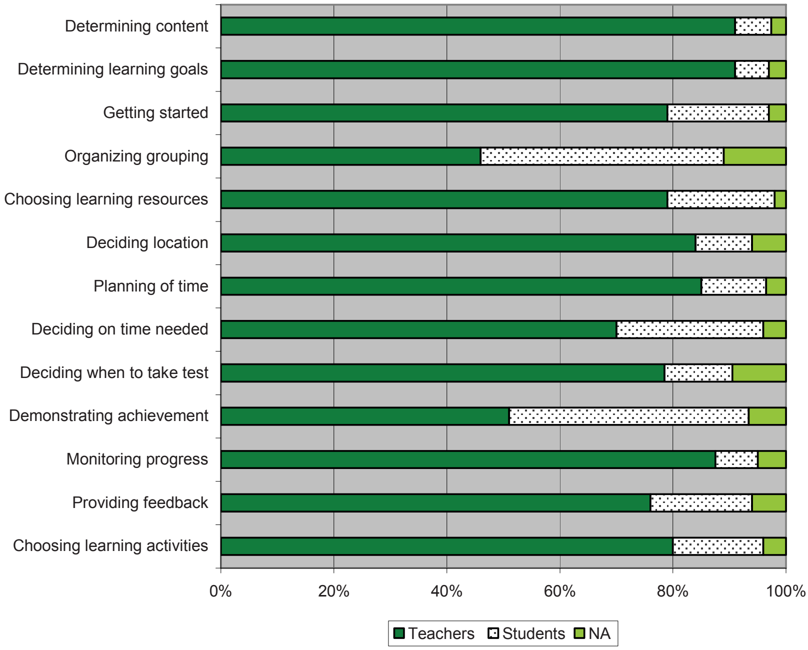
[1] School participation rate before including replacement schools is below 85%

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

[3] Teacher participation data were collected after survey administration

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

Figure 7.4a Mathematics teachers' identification of person initiating aspects of teaching and learning



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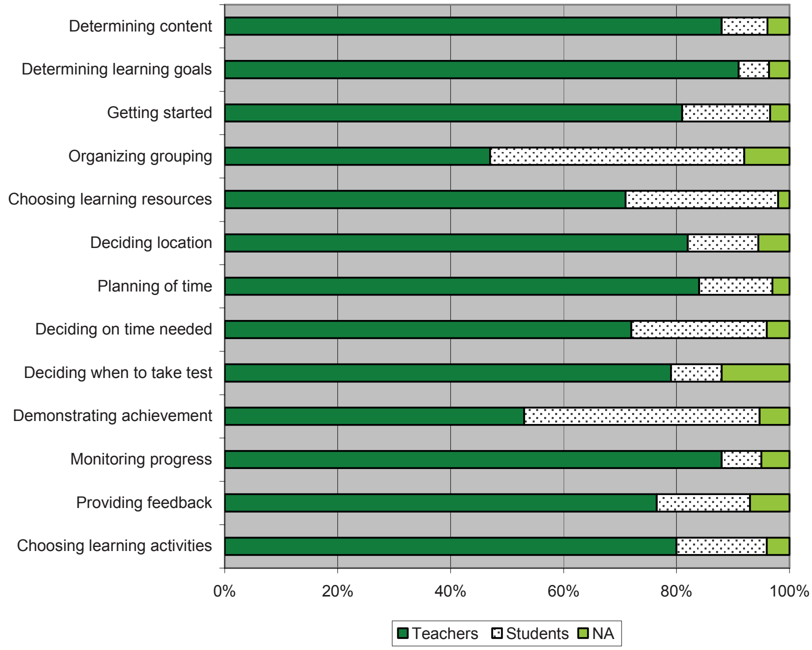
to 7.8 show the extent of cross-national variation on these four categories. Because of space constraints the figures cover mathematics teachers only; the results for science teachers appear in the online appendix (http://www.sites2006.net/appendix).

Figure 7.5 shows that a relatively large number of mathematics teachers from Moscow (18% of all mathematics teachers) and the Russian Federation (23%) reported that their students took the lead in determining the goals of their learning for the practice that each teacher had in mind. In addition, 23% of the mathematics teachers from the Russian Federation said their students were the initiators in determining the learning content of the specified activity.

Figure 7.4b Science teachers' identification of person initiating aspects of teaching and learning



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

With respect to the organization of location and time (Figure 7.6), 50% of the mathematics teachers from Slovenia, 41% from Chile, and 41% from the Slovak Republic said that students took the initiative in deciding how much time they need for learning. Of the curriculum components related to organization of the learning process, grouping in particular was seen by teachers as a student-based responsibility (Figure 7.7). Relatively large percentages of mathematics teachers in Thailand (76%), Chinese Taipei (66%), Finland (58%), Slovenia (56%), the Slovak Republic (55%), and Denmark (53%) expected students to take the initiative for organizing group work in the pedagogical practices that they had in mind.

Figure 7.8 presents the extent to which students were seen as taking the initiative in assessment practices. As observed earlier in this chapter, "demonstrating achievement" is an assessment practice wherein students are expected to take the primary initiative. This was particularly the case in Chile (72%), Ontario (59%), Chinese Taipei (58%), Moscow, (56%), Italy (55%), Alberta (53%) and the Slovak Republic (53%). A comparatively large proportion of mathematics teachers from Chinese Taipei (50%) reported their students took the lead in providing feedback.

Table 7.5 Student as initiator of aspects of teaching and learning; comparison of perceptions of mathematics teachers and science teachers who were using ICT on a weekly basis with those teachers who were using ICT during a specific period of the school year (% and (s.e.))

	Mathematics teachers		Science teachers	
Change in teaching practice	Use once a week	Use specific period in school year	Use once a week	Use specific period in school year
Determining content	07 (0.9)	06 (1.0)	08 (0.8)	09 (0.9)
Determining learning goals	09 (1.6)	05 (1.0)	05 (0.8)	06 (0.8)
Getting started	17 (1.5)	18 (1.4)	14 (1.1)	17 (1.1)
Organizing grouping	41 (2.2)	46 (1.7)	42 (1.6)	48 (1.4)
Choosing learning resources	17 (1.5)	20 (1.5)	24 (1.3)	28 (1.3)
Deciding location	10 (1.2)	11 (1.2)	12 (1.0)	12 (0.9)
Planning of time	11 (1.2)	12 (1.1)	12 (1.0)	14 (1.0)
Deciding on time needed	26 (2.1)	27 (1.5)	22 (1.2)	26 (1.2)
Deciding when to take test	13 (1.4)	11 (1.0)	11 (1.0)	08 (0.8)
Demonstrating achievement	41 (1.7)	45 (1.7)	43 (1.5)	40 (1.4)
Monitoring progress	09 (1.5)	07 (0.9)	07 (0.8)	07 (0.8)
Providing feedback	18 (1.7)	17 (1.2)	18 (1.2)	15 (0.9)
Choosing learning activities	17 (1.9)	17 (1.5)	15 (1.3)	17 (1.1)

7.8 Summary

This chapter reported the results for the 21 education systems that participated in the SITES 2006 international option. A main finding was that more Grade 8 science teachers than Grade 8 mathematics teachers reported using ICT in an extensive manner. Using ICT during a specific period (in a theme or a project) during the school year was considerably more common for both the mathematics and the science teachers in the majority of participating systems. The exceptions were Alberta, Chile, Hong Kong (science teachers only), Italy, Ontario, and the Russian Federation (mathematics teachers only).

Table 7.6 Mathematics teachers' perceptions of student as initiator in various aspects of teaching and learning (% and (SE))

	Education system	Determining content	Determining learning goals	Getting started	Organizing grouping	Choosing learning resources	Deciding location	Planning of time	Deciding on time needed	Deciding when to take test	Demonstrating achievement	Monitoring progress	Providing feedback	Choosing learning activities
	Catalonia, Spain	01 (0.8)	02 (0.9)	16 (3.3)	36 (4.3)	08 (2.9)	07 (2.2)	10 (2.2)	17 (3.2)	06 (1.8)	46 (3.7)	05 (1.4)	15 (3.0)	10 (2.5)
1	Chile	05 (1.5)	11 (2.0)	32 (2.6)	50 (3.2)	22 (2.7)	16 (2.3)	05 (1.8)	41 (3.5)	09 (1.9)	72 (2.9)	09 (1.7)	09 (1.9)	09 (1.9)
	Chinese Taipei	07 (2.6)	06 (2.1)	29 (4.1)	66 (4.5)	18 (3.4)	10 (2.7)	13 (3.0)	29 (4.0)	12 (3.2)	58 (4.3)	06 (2.1)	50 (4.6)	18 (3.5)
2	Finland	08 (3.3)	06 (2.9)	31 (4.8)	58 (6.1)	20 (4.4)	08 (2.7)	18 (4.3)	10 (3.5)	13 (3.4)	29 (5.4)	06 (2.5)	12 (3.5)	22 (4.5)
2	Hong Kong SAR	13 (2.7)	11 (2.5)	17 (2.3)	37 (3.7)	17 (2.7)	15 (3.0)	16 (2.9)	26 (3.4)	09 (2.1)	46 (3.8)	06 (1.6)	24 (2.9)	20 (3.1)
4	Israel	07 (2.7)	04 (2.0)	12 (3.2)	44 (5.2)	19 (4.4)	13 (3.0)	21 (4.0)	14 (3.3)	14 (4.1)	20 (4.0)	09 (2.9)	22 (4.7)	14 (3.4)
1	Italy	13 (2.1)	05 (1.4)	13 (2.3)	40 (3.0)	25 (3.0)	14 (2.3)	15 (2.5)	23 (2.9)	15 (2.5)	55 (3.5)	10 (1.7)	07 (1.4)	08 (1.6)
1, 3	Japan	05 (3.3)	10 (4.6)	15 (5.4)	05 (3.4)	12 (5.7)	07 (3.7)	02 (2.2)	10 (4.6)	02 (2.2)	07 (3.9)	05 (3.3)	07 (3.9)	19 (6.6)
2	Ontario Province, Canada	09 (2.1)	08 (1.8)	19 (2.3)	30 (3.0)	23 (3.0)	05 (1.4)	13 (1.9)	23 (2.8)	08 (1.9)	59 (2.9)	14 (2.9)	11 (1.9)	16 (2.6)
	Slovak Republic	01 (0.8)	01 (0.7)	04 (1.4)	55 (3.9)	19 (2.9)	09 (2.2)	04 (1.4)	41 (3.9)	29 (3.3)	53 (3.6)	10 (2.5)	25 (3.2)	14 (2.5)
	Slovenia	01 (0.7)	02 (1.1)	11 (2.3)	56 (4.0)	22 (2.8)	11 (2.2)	09 (2.1)	50 (2.9)	11 (2.1)	21 (2.6)	04 (1.3)	16 (2.7)	27 (3.2)
†, 2	Alberta Province, Canada	06 (2.0)	05 (2.3)	12 (3.0)	32 (3.8)	20 (3.4)	10 (2.8)	20 (3.2)	26 (3.7)	11 (2.4)	53 (4.2)	08 (2.5)	12 (3.0)	13 (2.9)
#	Denmark	13 (2.4)	05 (1.5)	06 (1.9)	53 (3.7)	23 (2.9)	25 (3.0)	28 (3.5)	15 (2.4)	03 (1.3)	37 (3.8)	15 (2.7)	11 (2.2)	33 (3.6)
#	Estonia	11 (4.4)	04 (2.6)	25 (5.8)	41 (7.1)	14 (4.6)	16 (4.8)	14 (4.4)	14 (4.1)	25 (5.6)	41 (6.4)	04 (2.4)	12 (4.2)	19 (5.3)
#	France	02 (1.2)	01 (0.9)	10 (3.1)	37 (4.1)	02 (1.2)	03 (2.0)	11 (2.7)	17 (3.7)	07 (2.8)	29 (4.6)	11 (3.2)	26 (4.8)	02 (1.1)
†, 2	Lithuania	03 (1.2)	06 (1.8)	20 (3.4)	42 (3.7)	26 (3.1)	30 (3.5)	22 (3.0)	28 (3.4)	22 (3.3)	36 (3.7)	14 (2.5)	09 (2.0)	16 (2.8)
†	Moscow, Russian Federation	11 (2.4)	18 (2.6)	19 (2.6)	22 (3.6)	29 (3.2)	13 (2.4)	28 (3.1)	18 (2.6)	12 (2.5)	56 (3.9)	11 (2.2)	27 (3.4)	17 (2.7)
#	Norway	05 (1.6)	05 (1.6)	02 (0.9)	31 (3.9)	22 (3.2)	07 (2.1)	12 (2.7)	11 (2.4)	11 (2.3)	37 (4.2)	12 (2.5)	12 (2.5)	24 (3.6)
†	Russian Federation	22 (3.6)	23 (3.8)	16 (3.5)	24 (4.1)	25 (5.0)	13 (2.9)	15 (3.7)	21 (3.9)	19 (5.0)	50 (4.0)	18 (3.4)	37 (4.7)	17 (4.6)
†	South Africa	03 (1.8)	07 (3.8)	11 (4.0)	21 (5.6)	08 (3.2)	07 (3.2)	03 (1.9)	06 (2.7)	07 (3.0)	37 (7.0)	00 (0.0)	11 (3.9)	00 (0.0)
†, 1	Thailand	11 (2.6)	04 (1.5)	11 (2.7)	76 (3.6)	28 (3.3)	32 (4.0)	11 (2.5)	13 (3.1)	17 (2.9)	10 (2.6)	07 (2.2)	23 (3.2)	19 (3.1)

Notes: Value labels for the response categories: 1=never, 2=sometimes, 3=often, 4=nearly always

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

[†] International procedures for target-class selection were not followed in all schools

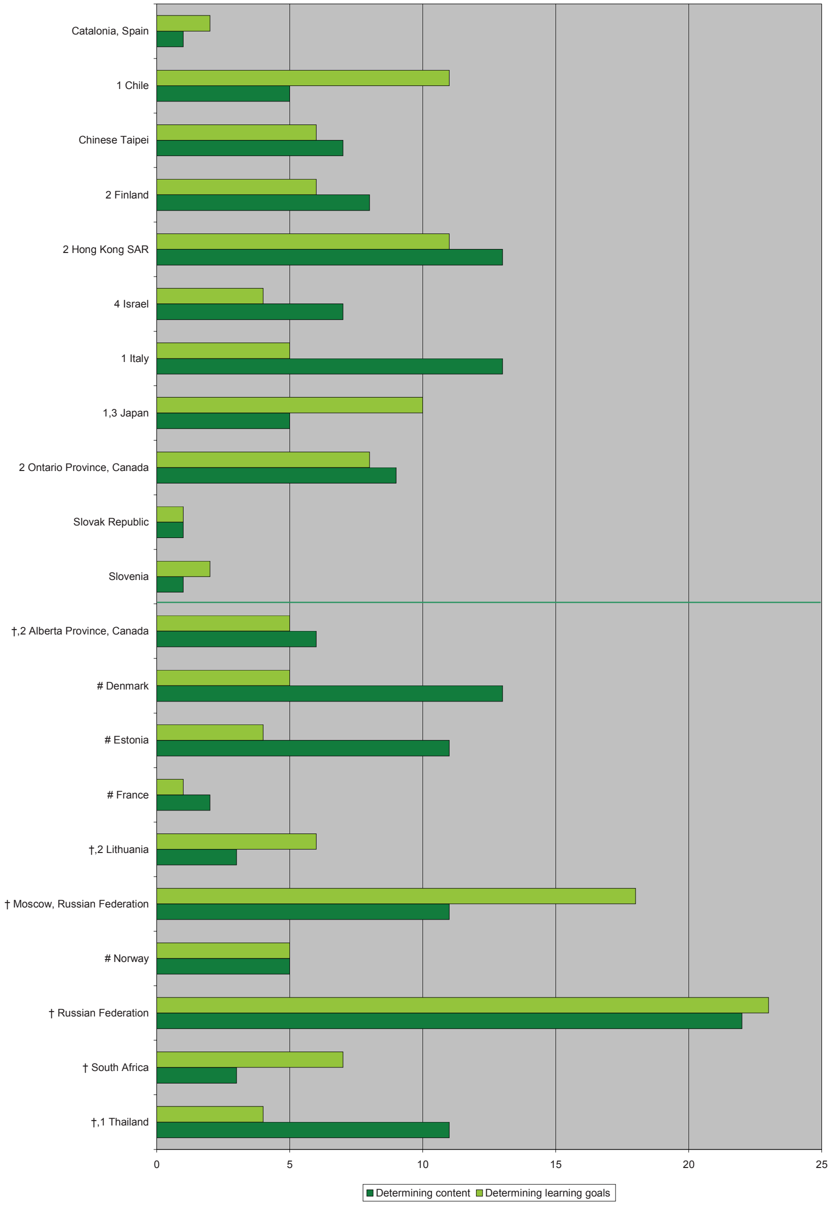
[1] School participation rate before including replacement schools is below 85%

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

[3] Teacher participation data were collected after survey administration

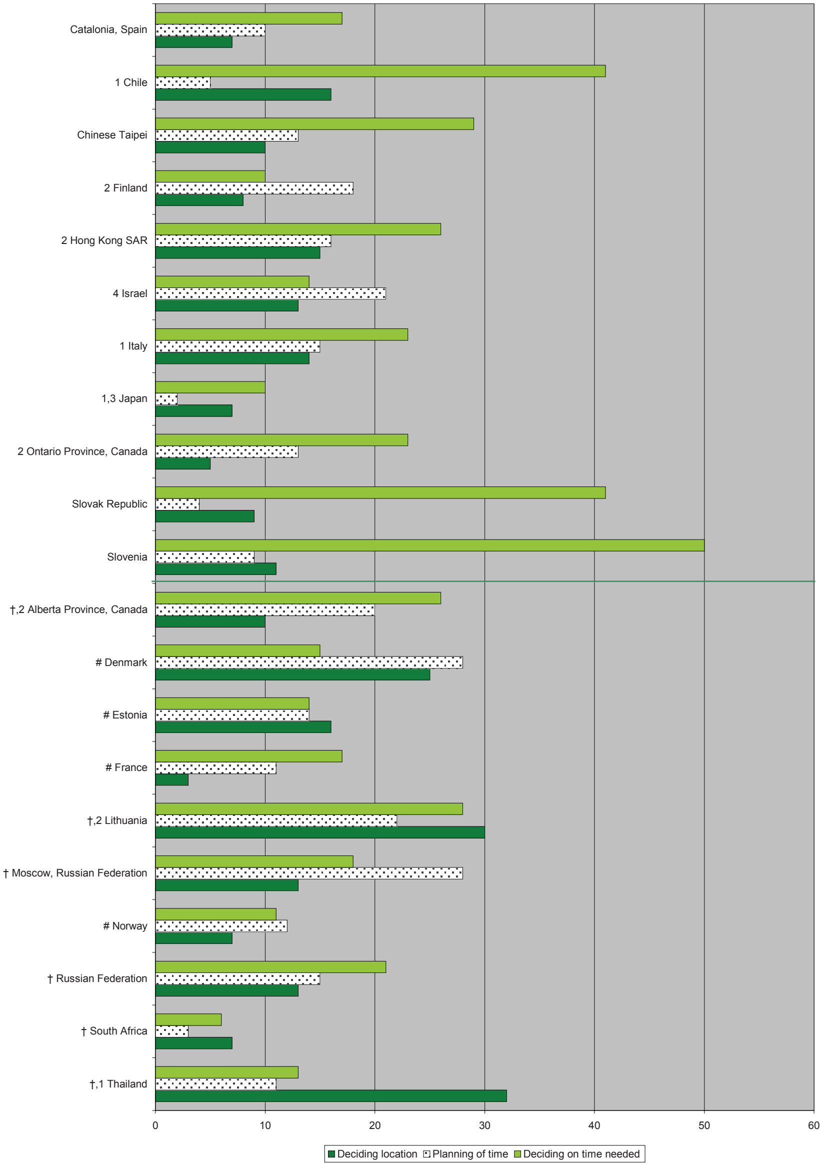
[4] Nationally defined population covers less than 90% of the nationally desired population.

Figure 7.5 Percentages of mathematics teachers reporting that their Grade 8 students initiated the content and learning goals of the specified pedagogical activity



Notes: # School participation rate after including replacement schools is below 70%
† International procedures for target-class selection were not followed in all schools
1 School participation rate before including replacement schools is below 85%
2 School participation rate after including replacement schools is below 85%
3 Teacher participation data were collected after survey administration
4 National defined population covers less than 90% of the national desired population.

Figure 7.6 Percentages of mathematics teachers reporting that their Grade 8 students initiated determination of the location, planning of time, and time needed for learning content related to the specified pedagogical activity



Notes: # School participation rate after including replacement schools is below 70%

† International procedures for target-class selection were not followed in all schools

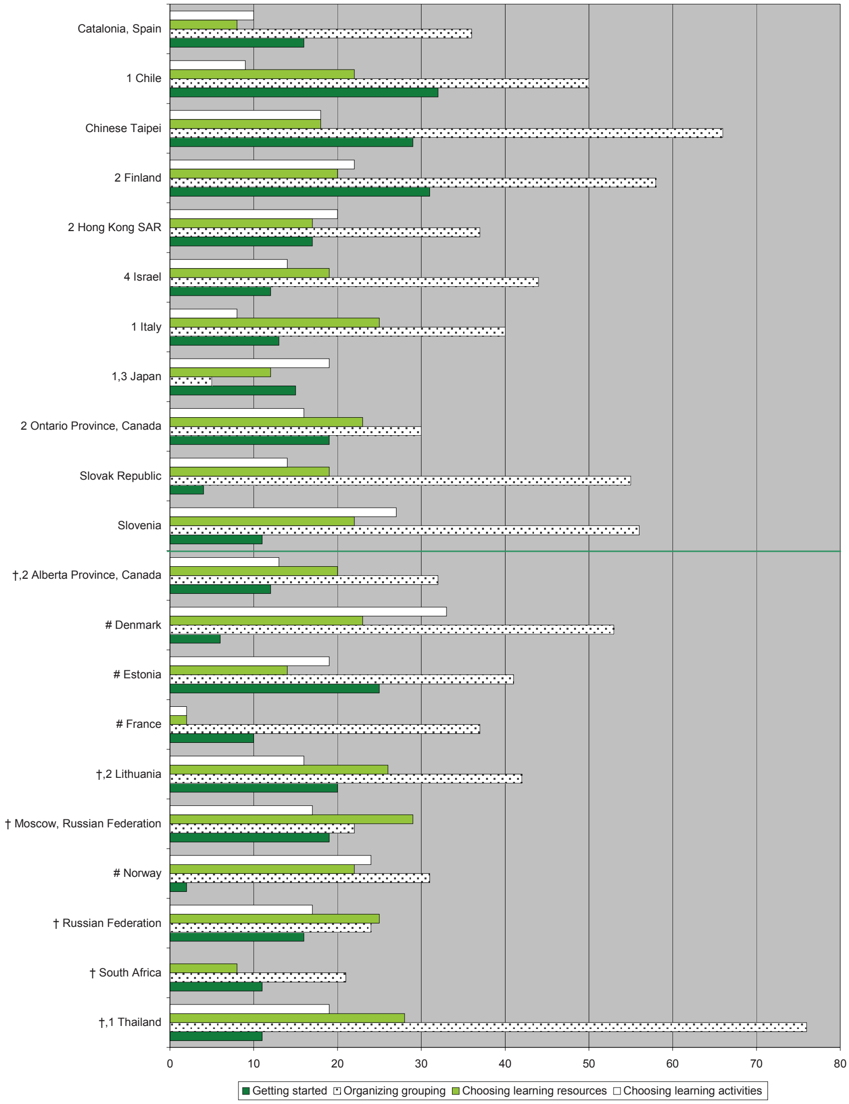
1 School participation rate before including replacement schools is below 85%

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

3 Teacher participation data were collected after survey administration

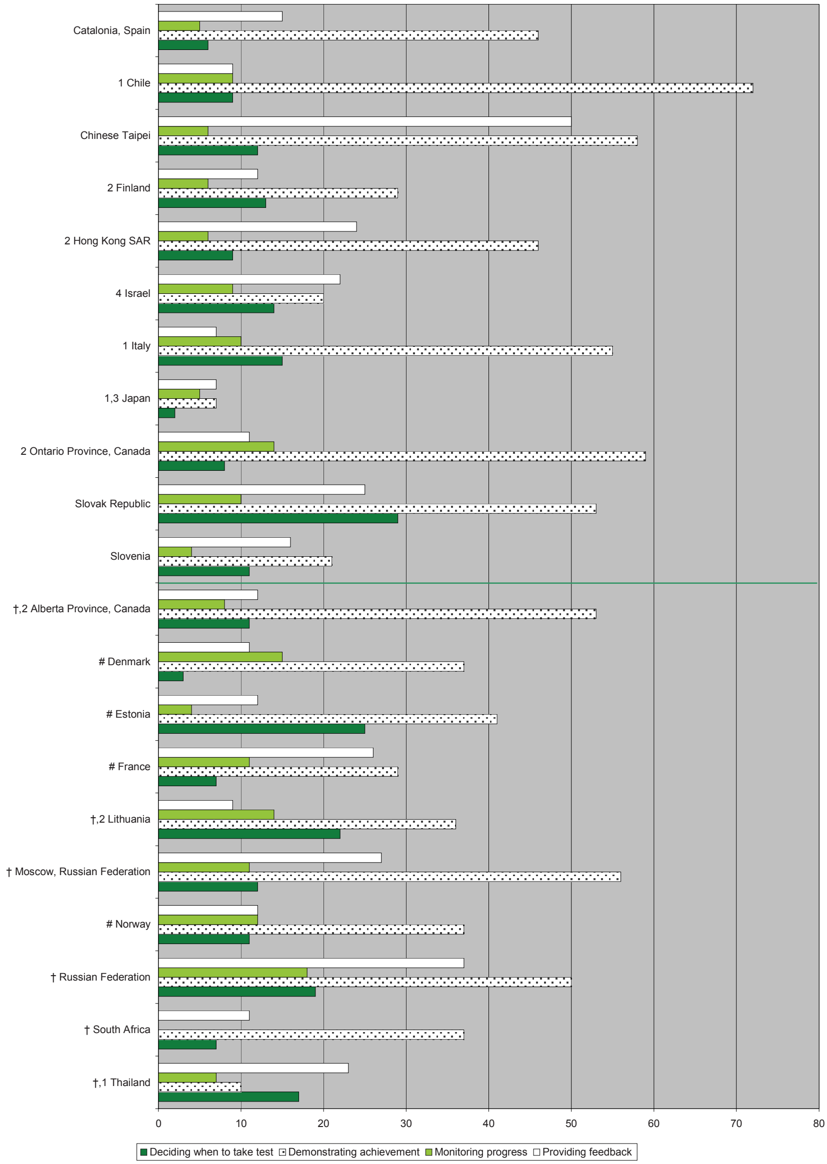
4 National defined population covers less than 90% of the national desired population.

Figure 7.7 Percentages of mathematics teachers reporting that their Grade 8 students initiated getting started on, choosing learning resources for, organizing grouping, and choosing learning activities related to the specified pedagogical activity



Notes: # School participation rate after including replacement schools is below 70%
† International procedures for target-class selection were not followed in all schools
1 School participation rate before including replacement schools is below 85%
2 School participation rate after including replacement schools is below 85%
3 Teacher participation data were collected after survey administration
4 National defined population covers less than 90% of the national desired population.

Figure 7.8 Percentages of mathematics teachers reporting that their Grade 8 students initiated deciding when to take a test, demonstrate achievement, monitor progress, and provide feedback in relation to the specified pedagogical practice



Notes: # School participation rate after including replacement schools is below 70%
† International procedures for target-class selection were not followed in all schools
1 School participation rate before including replacement schools is below 85%
2 School participation rate after including replacement schools is below 85%
3 Teacher participation data were collected after survey administration
4 National defined population covers less than 90% of the national desired population.

Both populations of teachers observed in relation to the pedagogical practice they had in mind an increase not only in their students' motivation to learn but also in their students' ICT-skills, information-handling skills, and subject-matter knowledge. The teachers also reported that using ICT in their teaching had increased the availability of new content and led to more varied learning activities and resources. More than half of the teachers mentioned that their ICT-use had increased the quality of their instruction and coaching, increased their ability to adapt their teaching to individual students, increased their self-confidence, and increased collaboration among their students. However, more than half of the teachers also reported an increase in the time they needed for lesson preparation. On most of these aspects, more of the teachers using ICT on a weekly basis reported changes than did the teachers using ICT during a specific period in the school year. This latter observation suggests that frequent use of ICT contributes to change in educational practice, a surmise that aligns with the findings of the Apple Classrooms of Tomorrow Project (Sandholtz, Ringstaff, & Dwyer, 1997).

Given the changes in teaching practices observed in this chapter, it would seem reasonable to assume a change in the distribution of responsibilities between teachers and students. However, the analysis showed that, in general, the teachers were still the main initiators of teaching and learning activities in the pedagogical practice they each had in mind. The only activities in which students took the lead were organizing grouping and demonstrating achievement, but even here less than half of both sets of teachers reported this situation.

According to the results of all three questions of the international option, teachers from some education systems (particularly Chile and Thailand) reported a relatively high number of changes relevant for the information society arising out of their use of ICT within their teaching and learning practices. Conversely, teachers from other education systems (notably Finland and Japan) reported relatively few such changes.