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ABSTRACT

The Computers in Education (Comped) study was designed as a two-stage survey. The first stage (1987-1990) was aimed at gathering information from a representative sample of schools at elementary, lower secondary and upper secondary level with regard to the state of computer use in education. The survey's focus was on the extent and availability of computers in schools, how computers are used, nature of instruction about computers, and the estimates of the effects that computers are having on students, curriculum, and the school as an institution. This publication describes Stage 2. The first part of Stage 2 was a repetition of the survey of Stage 1, with data collection centering on a school questionnaire. This enabled a longitudinal study of trends. Part 2 of Stage 2 studied the relationship between policy, practice, and outcomes with respect to computers in education relating variables referring to school, teacher, and classroom practice to student variables such as functional computer literacy, specific knowledge about and experiences with computers, performance in handling computers as well as attitudes towards computers and their uses. Ten countries (Austria, Bulgaria, Germany, Greece, India, Japan, Latvia, the Netherlands, Slovenia, and the United States) participated. Because thorough analyses have not yet been done, the presentation is mostly descriptive. The data collected are presented in 31 tables and 38 figures. Twelve appendixes, with an additional 30 tables, contain detailed information on participating countries, sampling, computer uses, and responses to specific questionnaire items. (Contains 56 references.) (SLD)

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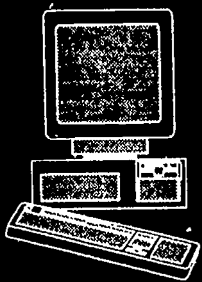

IEA-Comped Study Stage 2

W.J. Pelgrum, I.A.M. Janssen Reinen and Tj. Plomp (Editors)

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IR

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Foreword

This book is the first report of the second stage of IEA's study of Computers in Education.

IEA, the International Association for the Evaluation of Educational Achievement, was founded in 1959 for the purpose of conducting comparative studies focusing on educational policies and practices in various countries and education systems around the world. The participation in IEA has grown over the years from a small number of educational systems to a group of more than fifty until today. It has a Secretariat located in the Hague, the Netherlands. IEA studies have reported on a wide range of topics, each contributing to a deeper understanding of educational processes. The Computers in Education study (Comped) is a project shedding light on the way computers have been introduced in education and are being used nowadays across the world.

The Comped study is a two stage study with data collection for stage 1 in 1989 and for stage 2 in 1992. Stage 1 of the study has resulted in many publications (see the Publication overview), which in itself already demonstrates the richness of this study. With this report the International Coordination Center at the University of Twente, Enschede, the Netherlands, has started the publication of the results of stage 2 of the study. The project will be officially finished by the end of 1994, when the data base derived from this study will be made available via the IEA Secretariat and the Volume on stage 2 will be finalized.

IEA is very grateful to the following organizations which are the major contributors to the financing of the international overhead of the study: Ministry of Education and Sciences and the Institute for Educational Research (SVO) of the Netherlands, Commission of the European Community (Brussels), National Institute for Educational Research (NIER) of Japan and the National Science Foundation (NSF) of the USA.

This book is the result of efforts of many individuals. A special thank must go to the staff of the International Coordinating Center under the leadership of Willem J. Pelgrum, which did an excellent job under difficult budgetal conditions. I would also like to express my gratitude to the chair of IEA's Publications and Editorial Committee, dr. Richard M. Wolf for his support in realizing this book.

Those readers wishing additional information on this or other IEA studies may directly correspond to the IEA Secretariat in the Hague, the Netherlands.

Tjeerd Plomp
Chairman of IEA

Preface

The IEA Computers in Education study is an international cooperative effort to describe and analyze the situation with regard to the introduction and use of computers in education systems around the world. Data were collected in 1989 (Pelgrum & Plomp, 1991, 1993) and 1992 (stage 2). This book is the preliminary first report describing the results of the latter data collection. It is called preliminary, because it does not yet contain (due to delays in data collection or file production) the data from all countries, participating in stage 2 of the study. The final first report is planned to be released at the end of 1993.

This book is the product of many years of work by numerous persons. Much of the work was done by the National Project Coordinators (Appendix 1 contains their names), who helped in designing the study and collected all the data. The Steering Committee members (Ron Anderson, Tjeerd Plomp -chair-, Ryo Watanabe and Dick Wolf) as well as the sampling coordinator (Colm O'Muircheartaigh) offered invaluable help in advising the International Coordinating Center and assisted in making (sometimes difficult) decisions.

At the International Coordinating Center the data-manager Rien Steen and his team (Emmy Hornstra, Ria Marinussen and Arjan Schipper) skilfully and patiently constructed the database and conducted many of the required analyses.

Dick Wolf did a fantastic job by correcting the Dutch-English in the final manuscript in an amazingly short time.

A special word of thanks goes to Monique Kole who did much of the graphical work and produced the camera ready manuscript.

Willem J. Pelgrum (International Coordinator)

Educational Systems: acronyms and names of National Research Coordinators

Acronym	*System*	*National Research Coordinator*
AUT	Austria	G. Haider
BUL	Bulgaria	R. Nikolov
GER	Germany	M. Lang
GRE	Greece	S. Georgakakos
IND	India	A.K. Sharma
JPN	Japan	S. Matsubara
LAT	Latvia	A. Grinfelds
NET	Netherlands	A.C.A. ten Brummelhuis
SLO	Slovenia	M. Trobec
USA	United States of America	R.E. Anderson

Notes: Only systems included in this report.

1

Context and Content of the Study

Goals

The IEA study on Computers in Education was designed as a two stage survey. The first stage (1987-1990), was aimed at gathering information from a representative sample of schools at elementary, lower secondary and upper secondary level with regard to the state of computer use in education. It's major focus was on the extent and availability of computers in schools, how computers were being used, the nature of instruction about computers, and estimates of the effects that computers are having on students, the curriculum and the school as an institution, as well as other factors influencing the use of computers in schools. The information obtained from this stage was aimed to be of value for different audiences (such as policy makers, educators, curriculum and software developers, as well as computer manufacturers) and to contribute to scientific knowledge about processes and outcomes of educational innovations, as the introduction of the computer is one of the first innovations which could be studied from the beginning onwards.

Stage 2 of the study, with data collection in 1992, consisted of two parts. The first part was a repetition of the survey conducted in Stage 1. In this part, data collection centered on a school questionnaire (consisting of a principal and technical part), which was closely related to the school questionnaire used in Stage 1. In this way, it is possible to study developments of computer use in education over time.

Part 2 of Stage 2 was intended to study the relationship between policy, practice and outcomes with respect to computers in education. Specifically, the study aimed at relating variables referring to school, teacher, and classroom practice to student variables such as their functional computer literacy, specific knowledge about and experiences with computers, performance in handling computers as well as attitudes towards computers and their uses. Hence, in Stage 2 data were collected at three levels: school, teacher and student.

This chapter was written by Tjeerd Plomp and Willem J. Pelgrum.

The intended target populations for stage 2 were the same as for Stage 1, namely: primary (population 1: grade 5), lower secondary (population 2, grade 8) and upper secondary education (population 3, penultimate grade of secondary education).

Conceptual framework of the study

The measures taken in this study were based on a conceptual framework characterizing the educational system in terms of decision-making at different levels (see Pelgrum & Plomp, 1993): the macro- (national), meso- (school) and micro-level (class). The framework identified the factors contributing to effect changes. These factors can be found in the literature on educational change (e.g.: Fullan, Miles, & Anderson, 1988). It is necessary that the objectives of an innovation are perceived as clear and relevant by educational practioners who are involved in its implementation. Moreover, materials used in the innovation process (manuals, guidelines, teaching materials) should have a high quality. Continuous support for solving day-to-day problems as well as leadership within schools are also important conditions for stimulating teachers to adopt and implement the intended changes. Adequate facilities for training teachers and continuous staff development are necessary for learning a teacher how to translate the intended objectives into daily lesson practices. A system of continuous evaluation and the provision of feedback to actors involved in the innovation process at different levels in the educational system is important for monitoring the pace and direction of the changes..

The framework reflects the hierarchical structure of most educational systems, but acknowledges that decisions which promote or inhibit the implementation of computer-related curricula are made at all levels, which may cause discrepancies between decisions and expectations that exist at different system levels. An identification of these discrepancies may in itself be an important starting point for improvement measures in education.

Instrumentation of Stage 2

The instrumentation for stage 2 of the study is shown in Table 1.1.

The administration of the student tests and student questionnaire (except the international options) to one intact class of students per school took one lesson period.

Table 1.1
Instruments used in the comped study stage 2

- *School Questionnaire (principal part)*
- *School Questionnaire (technical part)*
- *Teacher Questionnaire Computer Education*
- *Teacher Questionnaire Existing Subjects (international option)*

For collecting student data, the following tests/questionnaires were used:

- *Functional Information Technology Test (FITT)*
- *Elementary programming test (national option)*
- *Performance tests (internat. option): Word Processing*
- *Attitudes scales: Enjoyment*
  Relevance
  Parental Support
- *Student description of computer use at school (general and within subjects) and home*
- *Student background characteristics (age, gender, SES, etc.)*

Participating educational systems and samples

Table 1.2 contains a list of the countries (and their acronyms), that participated in stage 2, while Appendix 1 contains the names of the National Research Coordinators responsible for conducting the study in each country.[3]

Due to delays in data collection in Israel and Thailand, these countries are not included in this book, but will be in later publications.

Appendix 2 offers a description of the samples (in terms of definitions, sample size, target grade level, age of students, and sample quality) that were drawn in each participating country. As shown by this description, most samples are considered to be representative for the system and population for which they were drawn. It should however, be noted that the sample of Greece consisted only of computer using schools. Moreover, insufficient information is available to determine whether any non-response bias exists in the German sample.

Table 1.2
List of countries participating in stage 2

Countries	
Austria (AUT)	Japan (JPN)
Bulgaria (BUL)*	Latvia (LAT)*
Germany (GER)	Netherlands (NET)
Greece (GRE)	Slovenia (SLO)
India (IND)	Thailand (THA)*
Israel (ISR)	United States of America (USA)

Notes: * = no stage 1 data collected.

About the content of this book

This report addresses a number of issues which played a central role in the publications which resulted from stage 1 of the study, in which 20 countries participated. These results were published in a first report (Pelgrum & Plomp, 1991), a research volume (Pelgrum & Plomp, 1993), national reports and articles in scientific journals (see publication overview at the end of this book). Some of the important conclusions of stage 1 will be summarized here and related to stage 2 data with reference to the chapters in this book where these issues are discussed from a longitudinal perspective.

Start of computer use

The most important reason schools mentioned in 1989 for starting to use computers was to prepare students through computer literacy, for their future in a society permeated with technology. Chapter 3 shows that this is still the case in 1992 in those schools which started since 1989.

Availability of hardware and software

The stage 1 data showed that the available hardware varies across and within countries, but the quantity of hardware tends to increase with the number of years schools use computers. In secondary education, computers were mainly located in special computer rooms or labs, while elementary education schools were more inclined to put computers in the regular classrooms. Similarly, a great variety of educational software was observed in schools, in which educational tool software (drill/practice, tutorial and educational games) as well as certain general purpose software (word processing and data base programs) were consistently at the top in all educational levels. The availability of computers in classrooms, as well as the availability of educational tool software tended to be associated with more integration of computer activities in the curriculum of 'existing' subjects (in stage 1: mathematics, science and mother tongue). Most educational practitioners (computer coordinators, principals and teachers) perceived shortage of hardware and software as the two main problems associated with introducing computers in the school curriculum; computer coordinators saw the acquisition of a greater variety of software as the highest priority. It was concluded that the critical mass of computers and software needed for a proper integration of computers into the curriculum was not yet reached; in other words, anno 1989 there was, generally speaking, still an insufficient basic infrastructure in schools for using computers. Chapter 2 shows that the availability of hardware and software in schools is slowly increasing, but that, except for the USA, substantial groups of students still do not seem to have access to computers at school.

Type of use

Based on the 1989 data, it was concluded that in secondary education, computers are used mostly as an add-on to the already existing curriculum in the form of teaching students how to use the computer. The most common practice in lower and upper secondary education is to offer this kind of instruction as a separate course; where such a course does not exist. In most cases, computer education is part of mathematics. Integration of the computer into the existing subjects of secondary schools was still in an initial stage. In elementary education, computers are most frequently used for drill and practice, while in secondary schools word processing and programming were most popular. Chapter 3 shows that this situation has not changed much between 1989 and 1992. Although at the school level a gradual increase of computer use in existing subjects can be observed in some countries, frequent use of computers by students in the context of these subjects hardly occurs.

Attitudes

In general, principals, computer coordinators and (computer using) teachers had a very positive attitude towards the use of computers in education in 1989. Attitudes of principals were positively correlated with the degree of their stimulation of using computers in their school; attitudes of teachers correlated positively with the intensity of using computers in their classroom practice. A strong association was found between the teachers' attitude about educational impact of computers and the degree to which pedagogical/instructional aspects were included in teacher (in-service) training. Chapter 4 shows that students also have positive attitudes about the relevance of computers and that they seem to enjoy using computers.

Staff development

In 1989 it was found that the amount of training received by teachers of existing subjects and the type of topics covered was related to the degree of computer integration. An important finding was that on the one hand being especially trained in pedagogical/instructional aspects of computer use, was found to be of relevance, but on the other hand, these topics were least covered in teacher training programs up till 1989. As the major use of computers in education was in the context of 'learning about computers', either as a separate subject or as part of an existing subjects, the study of staff development in this report is concentrated on teachers responsible for this. Chapter 5 offers a description of issues related to staff development in 1992.

Gender

In 1989 it was found that the daily practice in schools strongly suggested that the use of computers was predominantly a matter for males. Most schools did not seem to perceive this as a problem, as in most countries a majority of schools did not have a special policy for promoting gender equity with regard to computers. Where such a policy was reported, this seemed to be focused at offering more female role models for female students (for example, supervision of computer use by female teachers, special training for female teachers). Not much has changed in this respect since 1989 and it is not surprising to find (see Chapter 6) that in many countries stereotypical differences in terms of knowledge and attitudes between female and male students can be observed.

A general conclusion from the stage 1 findings was that the application and integration of computers in education is a very complicated process, expensive and beset with problems, requiring for lots of time-investments from educational practitioners (Pelgrum, Plomp & Janssen Reinen, 1993). Moreover, the setting of goals in this field is very complicated due to the fact that hardware and software applications are in a constant state of flux. It is in this context that the results of stage 2 of the Comped study will be presented and discussed.

2

Access to Hardware and Software by Schools and Students

Access to computers by schools and students

The equipment of schools with micro-computers occurred in most developed countries during the 1980s. With some exceptions, by 1989, a majority of secondary schools had access to computers. In most cases, they were used for administrative applications as well as for instructional purposes. For a number of countries presented in this report, the percentage of schools using computers for instruction was still low in 1989, 12% of the elementary schools in Japan and 53% in the Netherlands used computers for instruction, while at that time this was already 100% in the USA (see Figure 2.1). In lower secondary education, a relatively large number of schools in Japan and Austria and a smaller number in Germany and the Netherlands still did not use computers for instruction. In upper secondary education in Austria, Japan, Slovenia, and the USA almost all schools in 1989 were using computers for instruction. This was the case in only 7% of the schools in India. Figure 2.1 shows that this situation had changed considerably in 1992, when, at all educational levels, a majority of schools used computers for instruction. Sharp increases occurred especially in elementary schools in Japan and the Netherlands; lower secondary schools in Austria and Japan; and upper secondary schools in India.

Hence it seems that the 1990s started with a situation that in many countries computers had passed the front door of all schools and that within the schools the equipment was used for at least some educational applications. This does not necessarily mean that all students use computers. With only a few computers in a school, choices need to be made as to who may use the equipment which may result in a situation where part of the students have and others have not been involved in computer related tasks.

In order to find out about students' computer related activities, students were asked about their use of computers at school and outside school (at home, friends' home, hobby club).

This chapter was written by Willem J. Pelgrum.

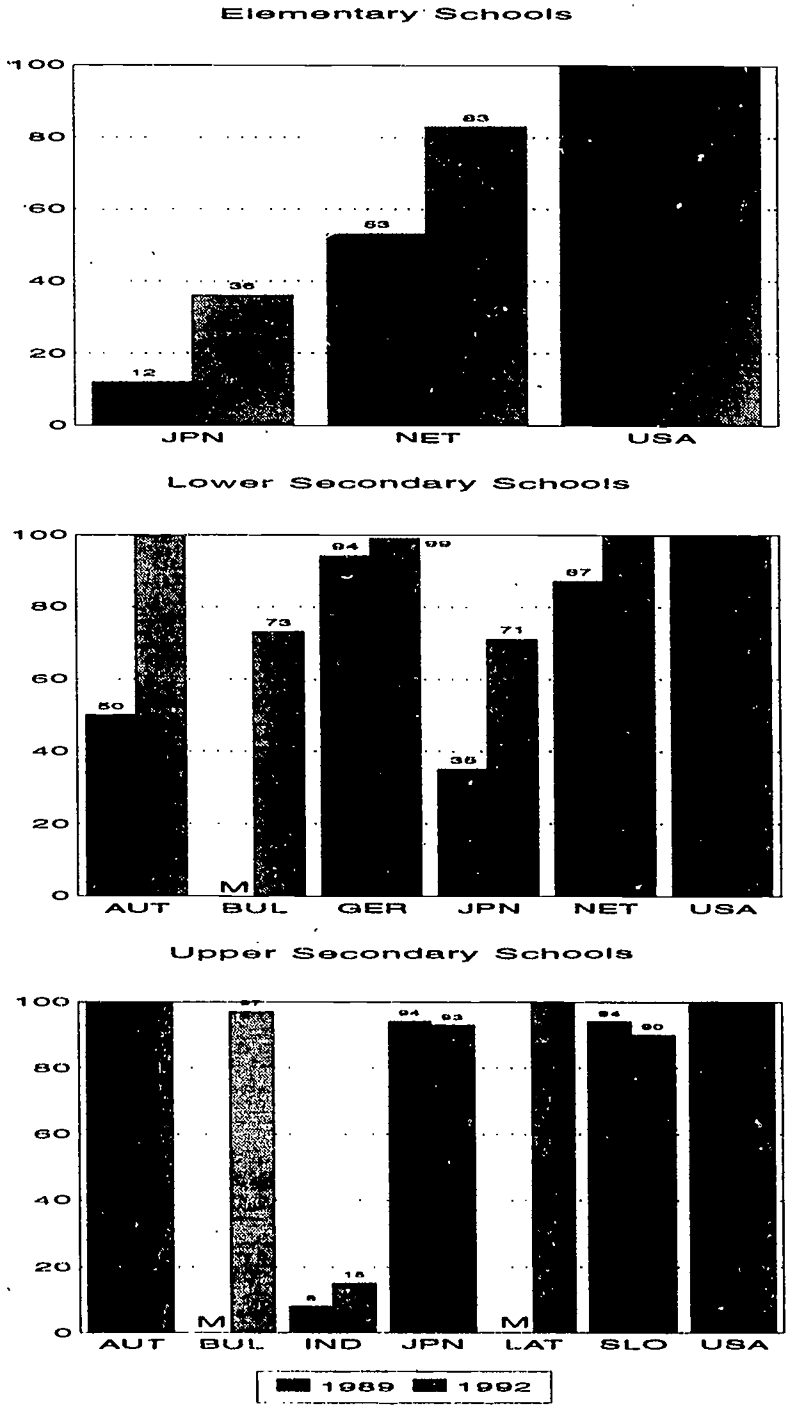


Figure 2.1 Percentage of schools having computers in use for instructional purposes in 1989 and 1992.

Table 2.1
Percentage of students in the target grade using computers in current school year (1992) in schools and/or outside school, at home and average weekly hours used at home

Country	School+ Outside	Only School	Only Outside	Not	At Home	Hours
Elementary Schools						
JPN	11	8	39	42	20	1.2
NET	50	12	27	12	52	3.4
USA	81	12	7	1	42	2.4
Lower Secondary Schools						
AUT	62	28	6	4	43	5.2
BUL	15	24	14	47	5	4.9
GER	59	18	16	7	58	7.0
GRE*	55	41	1	4	31	5.5
JPN	13	19	24	44	21	1.9
NET	60	17	16	6	57	4.0
USA	74	21	2	3	51	2.1
Upper Secondary Schools						
AUT	62	26	7	7	53	4.7
BUL	18	61	2	20	6	5.6
IND	2	6	3	89	1	4.4
JPN	23	26	16	35	27	2.3
LAT	27	53	3	17	11	6.6
SLO	40	29	12	19	28	4.2
USA	77	19	1	3	51	2.2

Notes: * Students in computer using schools only.

This resulted in four possible groups to which students may belong: (1) computer use outside school AND at school, (2) only at school, (3) only outside school, and (4) not at all. The percentages of students in a country in each of these groups are shown in Table 2.1. This table also shows percentages of students who use computers in their own homes and the amount of time they spent weekly in this activity. Figure 2.2

contains the percentages of students indicating that a computer was available at home and whether they had their own computer.

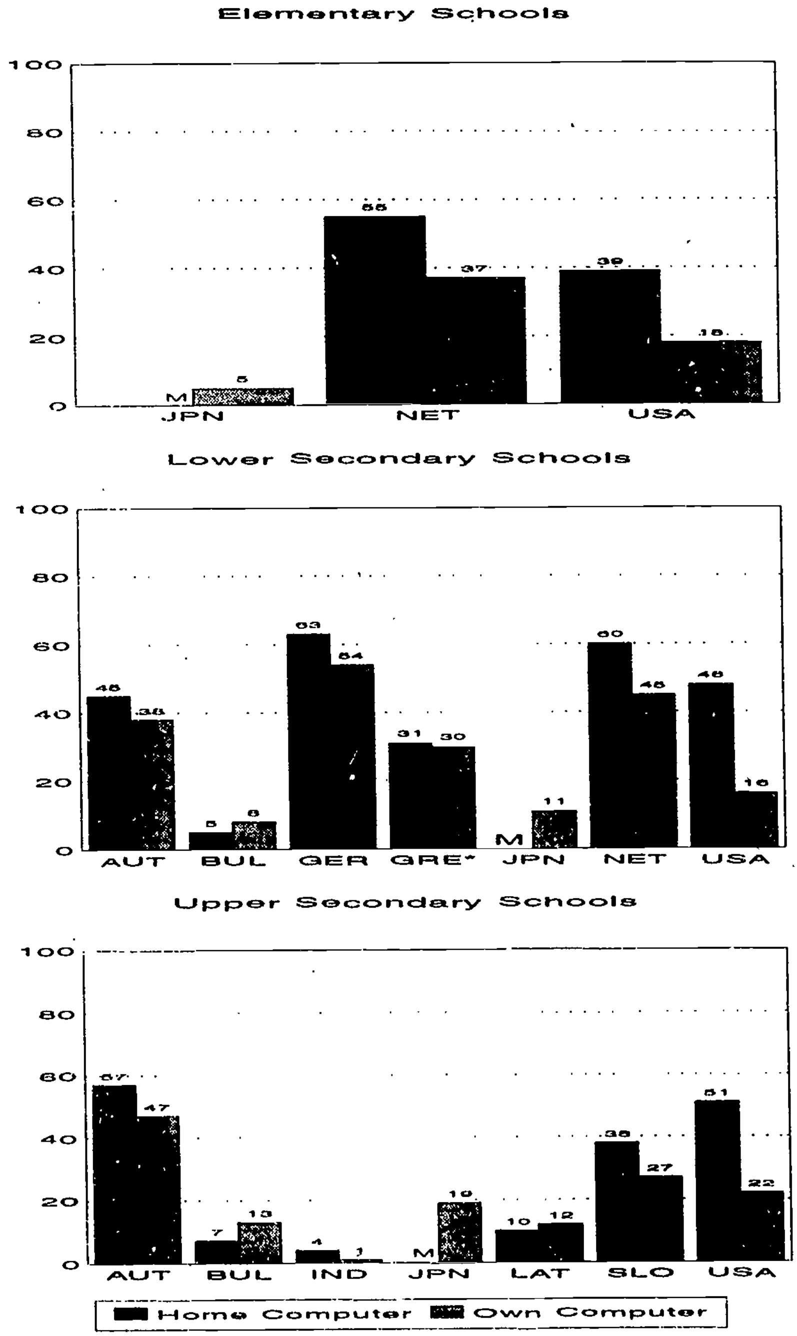
Figure 2.1 and Table 2.1 illustrate the discrepancy between availability of computers at school and actual use by students. For example, in 1992 in Japan 71% of the lower secondary schools used computers for instructional purposes (Figure 2.1), while only 32% of the students in grade 8 actually used computers in schools (Table 2.1).

With the exception of Austria and the USA, there were sizable groups of students who did not use computers at school in the school year 1991-1992. Table 2.1 also shows that there is still a considerable group of students in Bulgaria (47% in lower secondary schools), Japan (between 35 and 44 percent), and India (89%) who were not using computers at all in the school year the study took place, although, part of these groups may have gained computer experience before the school year 1991-1992. This indicates that in those countries computers are far from being integrated in the daily (school-)life of students.

It is noteworthy that, except for Bulgaria and Latvia, only a minority of students use computers *only* at school. One may also observe in Table 2.1 that the percent of students using computers in their own home is quite substantial in elementary schools in the Netherlands and the USA; in lower secondary schools except Bulgaria; and in upper secondary schools except Bulgaria, India and Latvia. The average number of weekly hours spent in home computing varies from low (for instance Japan) to a height of almost and equivalent of one hour a day in Germany and Latvia.

The use of computers outside school (in home and/or other places) is considerable, which is (as Figure 2.2 suggests) fostered by the relative large number of households where computers are available. Especially in Austria and the USA (upper secondary students), Germany, and the Netherlands these percentages are relatively high (above 50%). More than half of the students in Germany report that they have their own computer at home. This is the case for about 40-50% of the students in Austria and the Netherlands. Only a minority of students in the other countries have their own computer at home.

The fact that the percentage of students in Bulgaria and Latvia for 'own computers' is higher than for 'home computers' indicates that students were not consistent in answering these questions. A closer inspection of the data revealed that these inconsistencies also occur in other countries. Hence, the percentages in Figure 2.2 should be considered as a rough indicator, rather than a precise estimate.



Notes: M = information not available, * = students in computer using schools only.

Figure 2.2 Percentage of students indicating the availability of a computer at home and percentage having their own computer.

From the above, it seems that in many countries the lack of opportunities for students' use of computers at school is compensated by possibilities for use outside school.

The hardware situation in schools

In the first stage of the Comped study (1989) it was shown that hardware supplies in schools were still insufficient. Educational practitioners (school principals, computer coordinators and teachers), when confronted with a long list of potential problems, most frequently selected the problem of hardware shortage as one of the most serious when using computers in the school. Pelgrum & Plomp (1993) showed that the hardware availability in schools which started early with introducing computers is better than for schools who started later. Hence, it is not surprising to find (as shown in Figure 2.3) that since 1989 the hardware situation in schools has improved in terms of number of computers. In some countries, like Japan in secondary education and the USA, these changes are very substantial. Still, with the exception of upper secondary schools in the USA, the number of computers in a typical school in countries where the largest number of computers are observed is just enough for single student access for one class at a time.

However, there are many classes in a school who need to share the available equipment. This is illustrated by the student:computer ratio's in Figure 2.3. Although this index is based on school enrollment figures from the target grade and the adjacent grades (which underestimates the total enrollment), it shows that many students have to share the available hardware.

Although quantity of hardware is an important measure for indicating student access to computers, quality of hardware is an important measure for indicating to what extent the available equipment can run the more sophisticated educational software packages. A rough indicator for the quality of the available hardware in schools is the type of processor the computers are equipped with. The percentage of computers containing 16 bit or more powerful processors offers an indication of the extent to which the schools keep up the quality of their equipment with technological developments. Figure 2.4 shows a comparison between 1989 and 1992 of the average percentage of 16+ bits machines in computer using schools.

Figure 2.4 shows that the percentage of 16+ bit machines in computer using schools tends to increase, sometimes even considerably (for instance from 7% to 37% in elementary schools in the Netherlands, 17% to 76% and 3% to 29% in upper secondary schools in respectively Slovenia and the USA).

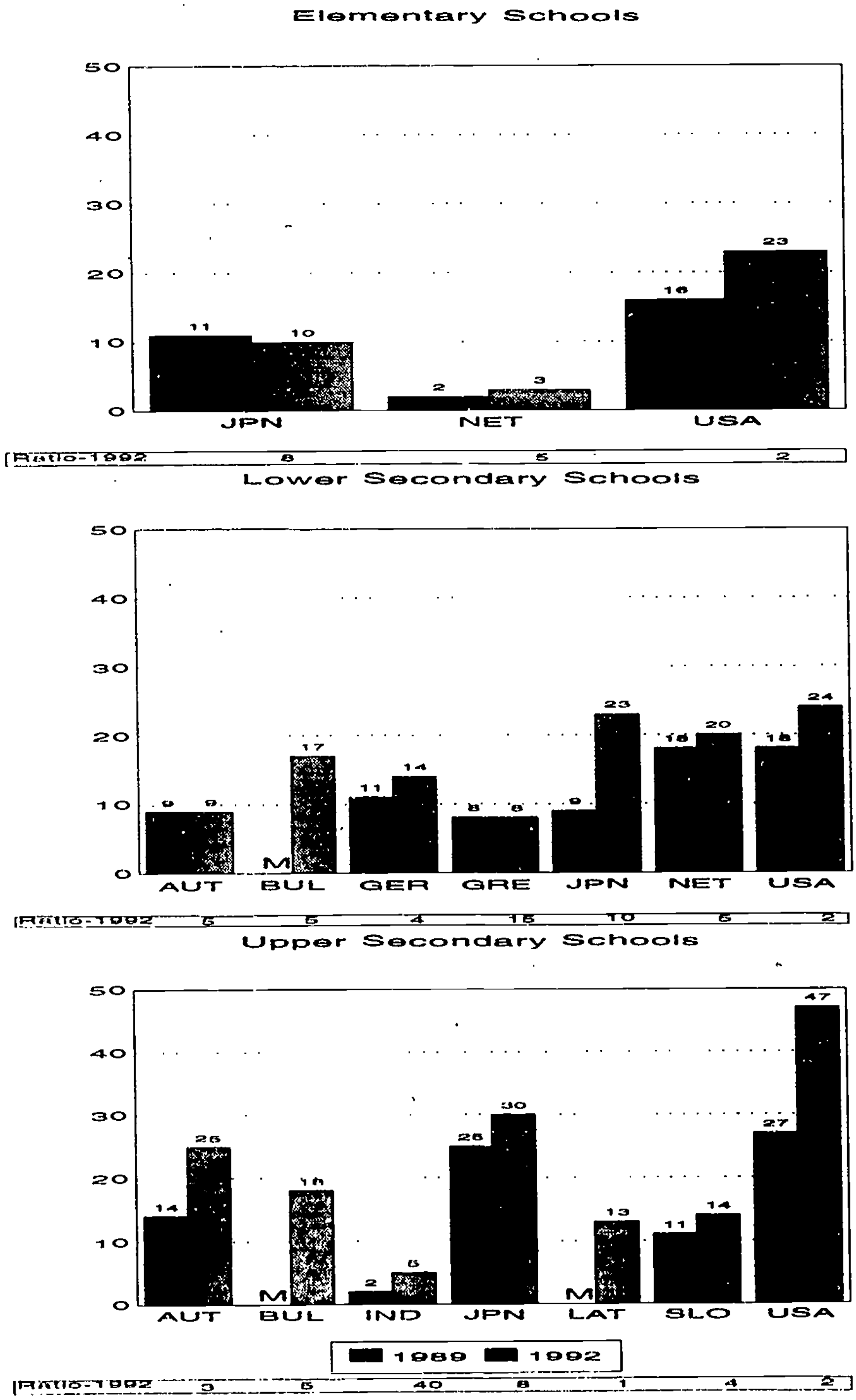
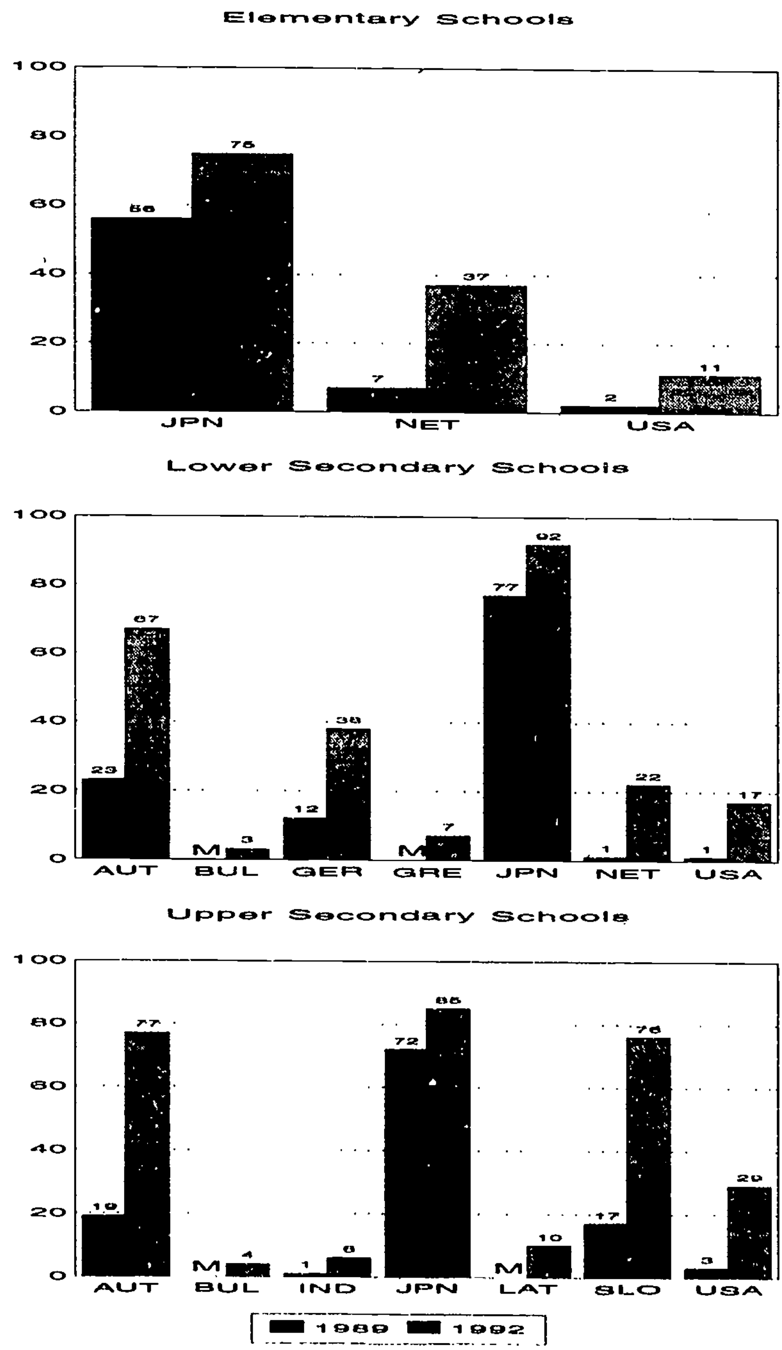


Figure 2.3 Median number of computers in computer using schools in 1989 and 1992 and median student:computer ratio's for 1992 based on enrollment at the target grade level.



Notes: M = information not available.

Figure 2.4 Mean percent of 16+ bit computers (80286 and higher processors) in computer using schools in 1989 and 1992.

However, it should also be noted that (except for Austria, Japan, and Slovenia) apparently most schools still have quite a number of old computers. For instance, the average percentage of 16+ bit machines in elementary and lower secondary schools in the USA is respectively only 11% and 17%, while in Austria, Japan, and Slovenia these percentages are much higher. This could be an illustration of the dialectics of progress, because the last group of countries started later with introducing computers in education than the USA. On the other hand, in the USA the supply of educational software for, for instance, Apple II is still such that these machines are considered worthwhile for educational applications.

Table 2.2
Percentage of computer using schools possessing peripherals

	CD-Rom	Videodisc	Modem
Elementary Schools			
JPN	21	17	20
NET	0	0	9
USA	25	11	29
Lower secondary schools			
AUT	0	0	10
BUL	1	1	3
GER	12	0	26
GRE	1	0	2
JPN	34	40	27
NET	32	1	48
USA	29	15	30
Upper Secondary Schools			
AUT	3	1	29
BUL	5	1	6
IND	9	8	2
JPN	13	18	33
LAT	1	0	2
SLO	0	2	19
USA	50	32	60

The extent to which schools have taken advantage of the latest technological developments is indicated in Table 2.2, which shows the percentages of schools having access to multimedia peripherals and modems for external communication. Table 2.2 shows that many schools still don't have access to these devices.

About 30% of lower secondary schools in Japan, the Netherlands and the USA and 50% of upper secondary schools in the USA have access to CD-ROM. Videodiscs are only available in a sizable number of Japanese lower secondary schools (40%) and USA upper secondary schools (32%). With the exception of Dutch lower secondary and USA upper secondary schools, there is only a minority of schools possessing a modem.

Table 2.3

Availability of external networks (Avail.) and frequency of use by computer using schools (percent of coordinators)

		Frequency of use			
Country	Avail.	Never	Some weeks	Most weeks	Weekly
Elementary Schools					
JPN	17	0	15	1	2
NET	2	2	0	0	0
USA	24	1	5	1	17
Lower Secondary Schools					
AUT	9	3	6	0	1
BUL	3	0	2	0	0
GER	5	1	1	2	0
GRE	0	0	0	0	0
JPN	13	2	7	3	0
NET	37	8	23	3	4
USA	23	1	7	3	12
Upper Secondary Schools					
AUT	28	4	19	1	3
BUL	3	1	2	0	0
IND	2	2	0	0	0
JPN	8	1	6	1	1
LAT	5	4	0	0	1
SLO	19	3	4	6	5
USA	39	5	14	4	16

One particular interesting development in the past ten years has been the implementation of communication networks which allow those who have access to a network to use services like electronic mail, information retrieval, and software exchange. In particular, the gradual replacement of words like New Information Technology (NIT) by Information and Communication Technology (ICT) is an indication of a shifting attention to the power of computers to assist in communication activities.

In 1989, computers were hardly used for electronic communication. As Table 2.3 suggests, this is still the case for most countries participating in this study: there are hardly any schools which have regular access to external networks, except for the USA where between 12% and 17% of the schools use computers almost weekly for access to external networks.

This indicates that communication networks did not yet play a significant role in education in 1992. One may, however, expect that, as schools tend to follow the major trends of office-computer use, this situation can change quickly over the next couple of years.

Perceptions of computer coordinators and students with regard to hardware shortage

As indicated above, hardware shortage in 1989 was seen by many educational practitioners as one of the major problems with regard to the use of computers in school. The previous section showed that the situation with regard to hardware supply in schools has changed since 1989, and hence one may expect that hardware shortage is also perceived as less pressing.

In 1989 and 1992, computer coordinators were presented with a list of 24 potential problems relating to computer use in the school (such as problems regarding availability and quality of hardware and software, organizational and curricular issues, and teacher training). In 1989, the question was to check each problem in the list to indicate whether that problem was seen as serious. In 1992, the coordinators were asked to judge for each problem whether it was minor, major or not existent. Appendix 3 contains the percentage of coordinators checking each problem in 1989 as well as the percentage indicating that a problem was major in 1992. Due to the somewhat different format of the questions in 1989 and 1992, one should be cautious in comparing the percentages from 1989 and 1992. Appendix 3 shows that the percentages for 1992 are almost consistently lower than those for 1989. Therefore, it is safe to compare the rank orders of the problems in 1989 and 1992.

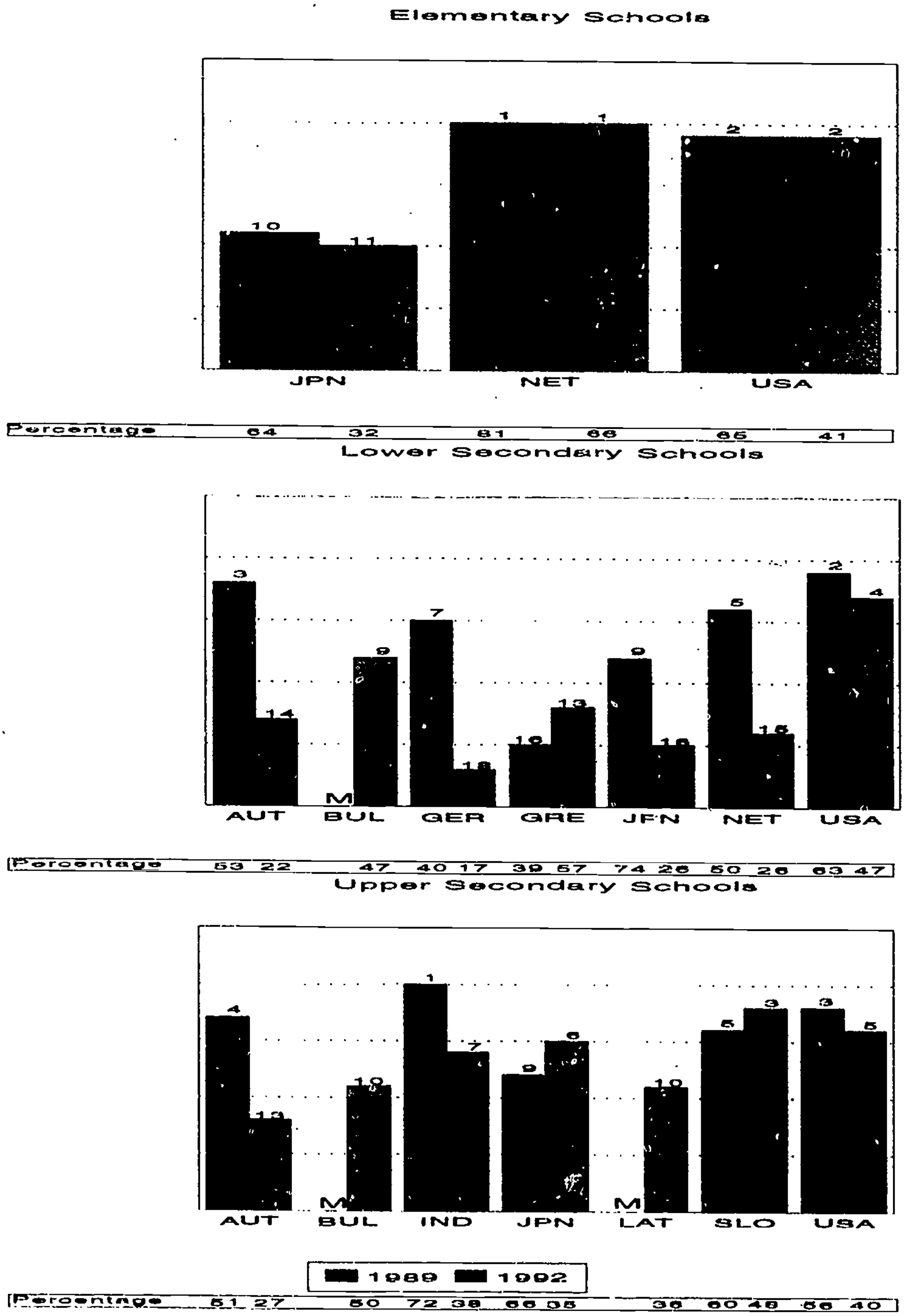


Figure 2.5 Rank order of the problem "insufficient number of computers" and percentage computer coordinators in 1989 and 1992 that perceived this as a problem (see text for percentage interpretation).

For the problem "There are insufficient computers available in the school" these rank orders for 1989 and 1992 are shown in Figure 2.5. A high rank number of one means that a problem is seen as serious by a relative large group of coordinators, whereas a number of, for instance 15, means that a problem is seen as much less serious.

From Figure 2.5 one may infer that in elementary schools in the Netherlands and the USA insufficient availability of hardware is still seen as one of the major problems. In secondary education there is a clear trend (except for Greek lower secondary schools and upper secondary schools in Japan and Slovenia) that the problem of insufficient number of computers is declining somewhat.

Table 2.4

Percentage of students (using computers at school) reporting frequency of occurrence of computers not being available in school when they want to use them

Country	Never	Sometimes	Often	Very often
Elementary Schools				
JPN	48	24	10	19
NET	42	45	7	6
USA	21	40	20	19
Lower Secondary Schools				
AUT	43	34	9	14
BUL	38	43	7	12
GER	47	33	9	11
GRE	50	31	8	10
JPN	66	18	5	11
NET	73	22	3	2
USA	29	43	16	12
Upper Secondary Schools				
AUT	43	40	8	10
BUL	35	35	14	16
IND	22	51	14	13
JPN	67	18	7	8
LAT	21	43	19	16
SLO	34	32	18	17
USA	35	38	15	12

These changes imply that other problems are becoming more pronounced in the perception of computer coordinators. Such an observation is also consistent with problems students experience. Table 2.4 suggests that, from those students who use computers in school, only a relatively small group, less than a quarter, except for Bulgaria (upper secondary), India, Japan (elementary level), Latvia, Slovenia and the USA, reports that computers are often or very often not available in school when they want to use them. This indicates that, in most countries, from the student perspective, there does not seem to be a pressing need for increasing the availability of hardware in the school. Possible causes for this observation (such as, for instance, the extent to which computers are used at home) will be sought in future analyses.

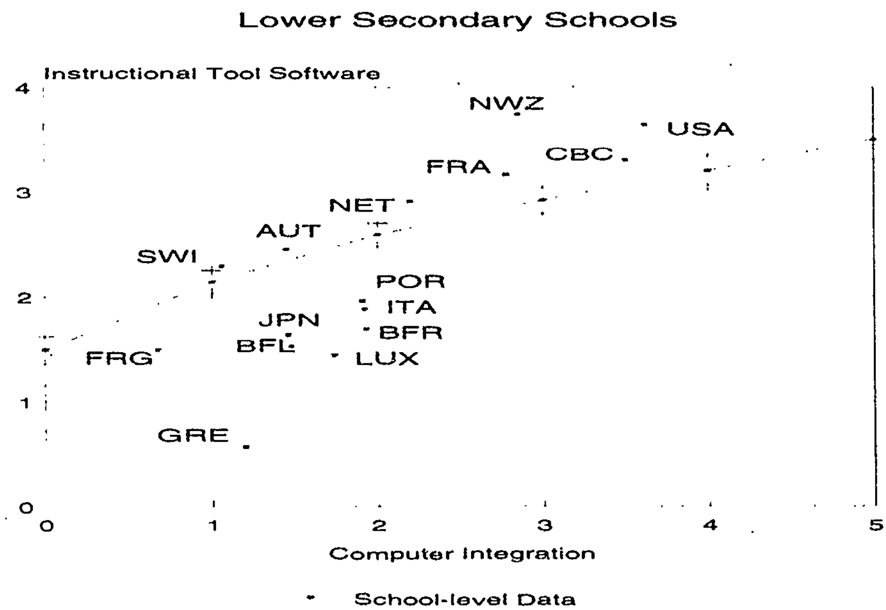
The software situation in schools

In order to be able to describe what type of software schools possess, computer coordinators were asked to check in a list of 23 software types which of these were available in the school. Appendix 4 contains this list as well as the percentages of coordinators in 1989 and 1992 who checked each item.

One of the interesting findings in the 1989 data was that schools which favored one particular type of software, namely instructional tool software for drill and practice, tutorials, etc. over other types (like programming languages, general application programs, laboratory software) also tended to place more emphasis on the integration of computers in the curriculum. A typical finding (from Pelgrum & Schipper, 1993) for all countries participating in stage 1 of the study, is provided in Figure 2.6.

In this figure, the indicator 'instructional tool software' is determined by counting how many of 5 types of software (drill and practice, tutorial programs, music composition programs, educational and recreational games) are available in the school. Therefore the maximum score is 5. The indicator 'computer integration' consists of counting for which of 5 activities (Computer Assisted Instruction, students play games, remediation, enrichment and tests on computers), computers are used in schools. Although both indicators are very rough, Pelgrum and Schipper (1993) demonstrate that both are very useful for descriptive purposes.

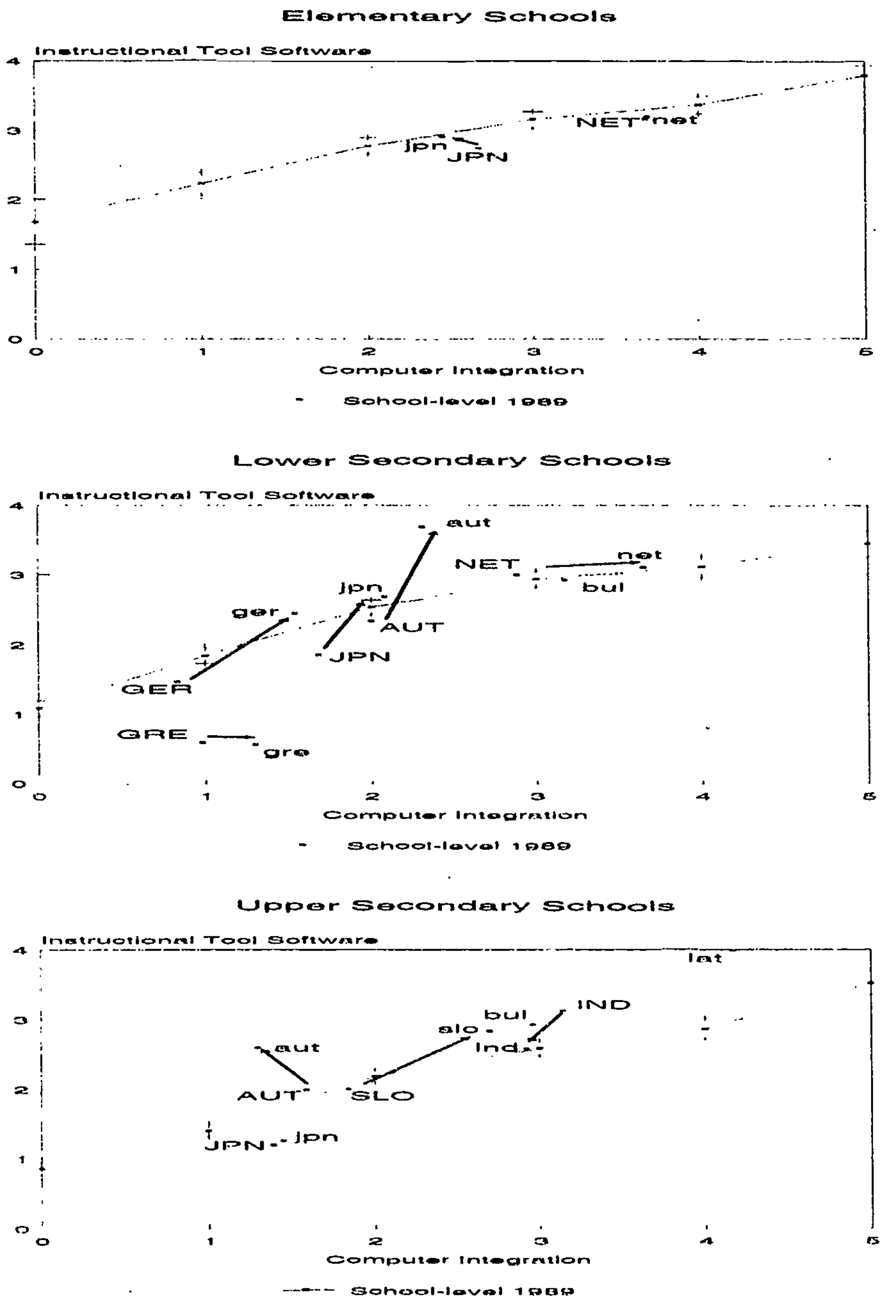
In order to determine to what extent the potential causal relation in Figure 2.6 is confirmed by a longitudinal comparison, we have plotted in Figure 2.7 the country means on both indicators mentioned above for 1989 as well as 1992.



Notes: + = 95% confidence interval. The abbreviations for the systems only included in stage 1 are as follows: BFL = Belgium-Flemish, BFR = Belgium-French, CBC = Canada-British Columbia, FRA = France, ITA = Italy, LUX = Luxembourg, NWZ = New Zealand, POR = Portugal and SWI = Switzerland.

Figure 2.6 Emphasis on integration of computers (mean values) at school level plotted against the availability of instructional tool software. Source: 1989 data from Pelgrum and Schipper (1993).

In order to make a comparison over years, we selected schools which started to use computers before 1989. Figure 2.7 shows that, in elementary schools, hardly any changes with regard to the availability of instructional tool software occurred and that at the same time the emphasis on integration of computers stayed the same. For the Netherlands this is not unusual, because the country means reach almost the maximum on both scales. In lower secondary schools there is growth on both indicators (except in Greece and the Netherlands with regard to instructional tool software). In the Federal Republic of Germany the availability of instructional tool software increased considerably as well as the integration of computers into the curriculum. In upper secondary schools, the results for Austria look unusual, because there is an increase in instructional tool software but a decrease for integration in the curriculum.



Notes: +=95% confidence interval.

Figure 2.7 Country positions (for 1989 in upper case and 1992 in lower case) and school level data (for 1989) on degree of computer integration and availability of instructional tool software.

An explanation for this result has not yet been found. In India the values for both indicators decreased which is consistent with results reported in the next chapter, and may be explained by changes in policies with regard to educational computer use. In Japanese upper secondary schools, the situation is almost the same. In Slovenia, there was a slight increase on both indicators.

Thus, Figure 2.7 shows a partial confirmation of the idea that more availability of instructional tool software is also, across time, associated with more integration of the computer into the curriculum. Further analyses will be needed to determine the causal character of this relation by examining which of these indicators is the cause or the effect.

Perceptions of computer coordinators and students with regard to software

The data of stage 1 of the study revealed that the lack of instructional tool software was seen by almost all respondents as a very serious problem, next to the shortage of hardware. This is clearly illustrated in Figure 2.8 and Appendix 3. When, in 1989, computer coordinators were asked to prioritize items for next years' budget, most chose for more instructional software instead of items such as a larger number of computers, more powerful computers, or more tool software.

According to the perceptions of computer coordinators, the shortage of software is seen as relatively less serious in 1992 than in 1989 (see Figure 2.8). Although in most countries the rank orders for 1992 are lower than in 1989, the differences are less marked than for the shortage of hardware as a problem (see Figure 2.5). In Japanese and Dutch elementary schools, software shortage is still relatively high, while in the USA computer coordinators are much less dissatisfied with the available software supplies in their schools. In lower and upper secondary schools, one may also observe a decreasing trend, which is most pronounced in Slovenia and the USA. In the other countries the availability of software is still seen as rather problematic.

In order to shed some light on the question to what extent students perceive software as user friendly, students were asked how often programs were difficult to handle or understand. In Table 2.5 the percentages of students are listed who used computers in the 1991-1992 school year and who indicated that this problem occurred never, sometimes, often or very often.

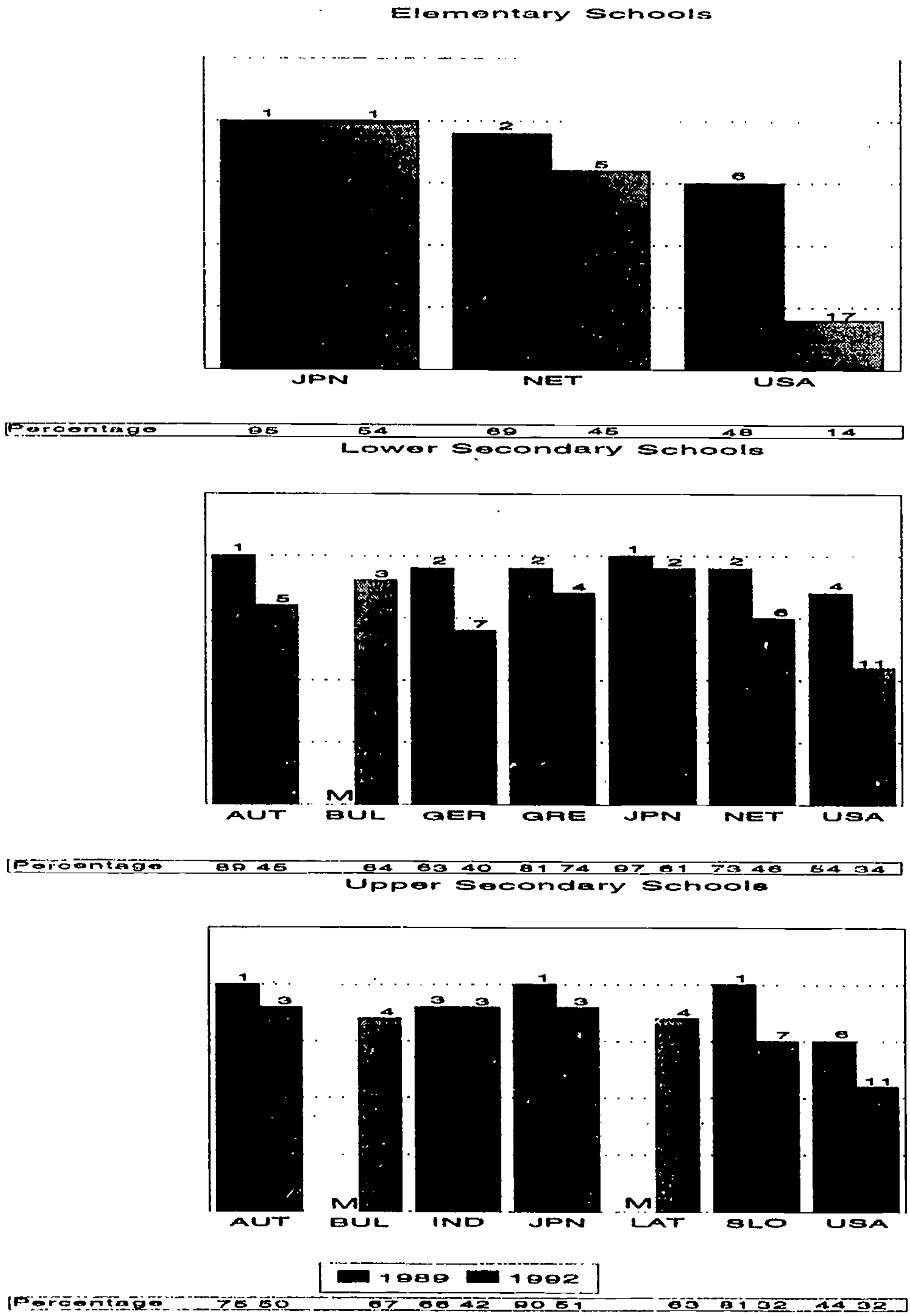


Figure 2.8 Rank orde- of the problem "not enough software for instruction" and percentage computer coordinators in 1989 and 1992 that perceived this as a problem (see text for percentage interpretation).

Table 2.5

Percentage of computer using students reporting frequency of occurrence that programs are difficult to handle

Country	Never	Sometimes	Often	Very often
Elementary Schools				
JPN	49	20	11	21
NET	41	53	5	1
USA	31	49	12	7
Lower Secondary Schools				
AUT	21	64	11	3
BUL	25	53	13	8
GER	19	57	16	8
GRE	24	59	12	5
JPN	46	25	16	13
NET	33	58	6	3
USA	36	47	11	5
Upper Secondary Schools				
AUT	27	59	11	3
BUL	20	60	13	8
IND	30	53	12	5
JPN	25	27	26	22
LAT	12	57	22	8
SLO	17	46	28	10
USA	41	43	12	5

A relatively large group of Japanese students in elementary schools (49%) and lower secondary schools (46%) indicate that this problem never occurred. On the other hand the percentages of Japanese students indicating that the software is very often difficult, is also relatively high. In other countries these percentages are much lower. A possible explanation offered by the Japanese National Research Coordinator is that Japanese software is rather sophisticated and therefore rather difficult for beginners. Once students are accustomed to the software these problems disappear. From the percentages of students indicating that software complexity is a problem, one may infer that a further investigation into the nature of these problems and their possible solutions is needed.

Summary

The findings, reported above show that in most countries in a relatively short period (three years) considerable change had taken place with regard to hardware and software availability. Although the observed improvements with regard to hardware availability are noteworthy, it is unclear what the educational impact of these changes has been. Slight increases in the integration of computers in the curriculum tend in some countries to coincide with increases in the availability of instructional tool software. These observations and the fact that from a global point of view sizable groups of students do not seem to have access to computers give rise to the question to what extent the way in which computers have been used in schools has changed. The next chapter present results with regard to this question.

3

How Are Computers Used in Schools?

Reasons for using computers

Any information about how computers are used in schools should be interpreted in the context of why schools started to use computers. One reason, often mentioned in the literature from the 1980s, is that students need to be prepared for the information society in which computers play an important role. From Table 3.1 one may infer that *in order to give students computer experience they might need in the future* was indeed the reason most frequently mentioned by school principals (in 1992) for starting to introduce computers.

Table 3.1
Percent of principals mentioning reasons for introducing computers as (very) important

	Elementary Schools			Lower Secondary Schools							Upper Secondary Schools						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
A.	62	82	96	97	90	98	97	80	97	96	99	97	88	84	99	100	100
B.	43	47	77	73	58	64	77	56	67	68	71	68	74	53	90	88	56
C.	13	7	14	25	38	7	12	23	34	15	38	49	43	57	75	49	12
D.	34	68	83	39	60	32	42	38	62	78	41	67	72	37	69	79	84
E.	56	49	95	81	78	94	78	74	68	94	74	84	66	71	85	88	90
F.	56	77	79	58	46	42	38	65	59	70	41	60	58	38	69	68	67
G.	34	32	46	50	22	36	61	38	19	50	42	32	55	23	52	59	41
H.	77	39	56	17	29	19	64	71	41	48	15	36	60	75	70	74	50
I.	57	84	71	74	44	65	61	49	89	63	79	50	63	62	49	83	71

Notes: The original wording of the reasons is:
A. To give students experience with computers that they will need in the future;
B. To make school a more interesting place for current students;
C. To attract students to the school;
D. To improve student achievement in the school;
E. To keep the curriculum and methods up-to-date;
F. To promote individualized learning;
G. To promote cooperative learning;
H. This school had an opportunity to acquire computers;
I. Teachers were interested.

This chapter was written by Willem J. Pelgrum, Arjan T. Schipper and Tjeerd Plomp.

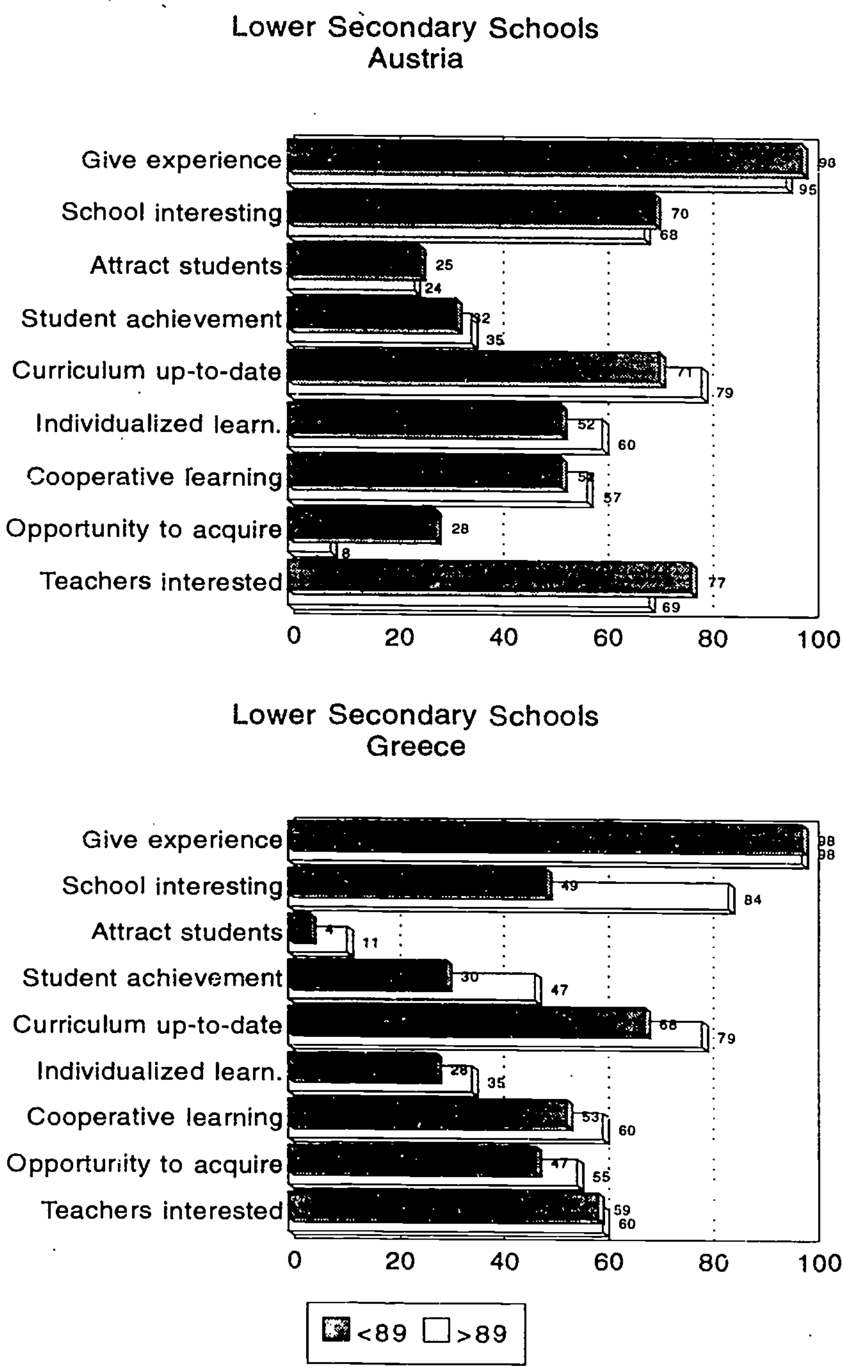
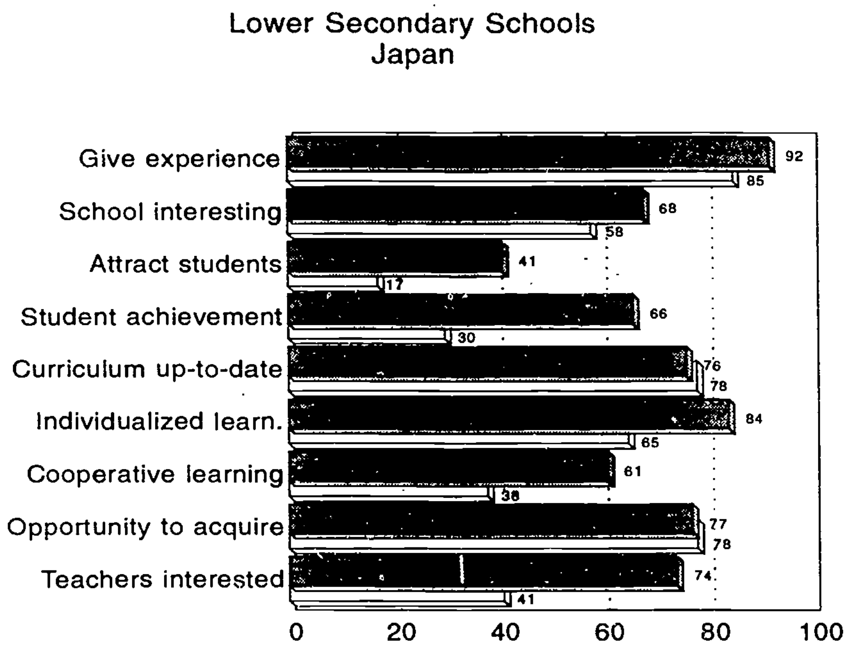


Figure 3.1 Percent of principals mentioning reasons for introducing computers as important or very important for schools which introduced computers in 1990 or later (1992 data) versus schools which introduced computers in 1988 or before (1989 data).



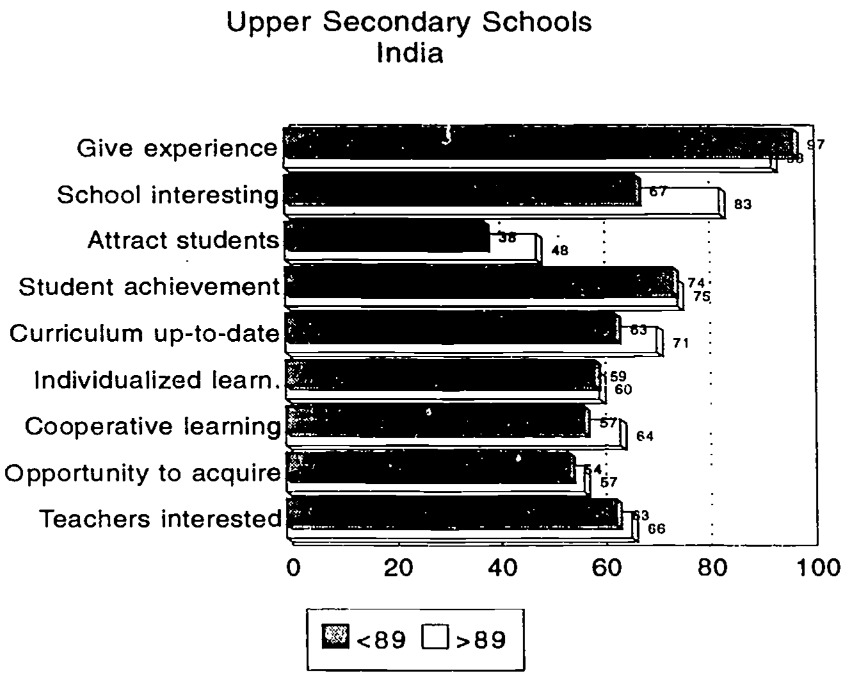


Figure 3.1 (continued) Percent of principals mentioning reasons for introducing computers as important or very important for schools which introduced computers in 1990 or later (1992 data) versus schools which introduced computers in 1988 or before (1989 data).

Keeping the curriculum up-to-date is also important and this reason for introducing computers is generally ranked second or third. One should, however, also note that 'opportunistic' reasons like *attracting students to the school* or *the opportunity to acquire equipment* (for instance, via a governmental program) played a role, according to the school principals.

In a few countries and only at the secondary level, the sample contained enough schools (at least 15% of the sample and minimally 35 cases) that started to use computers recently (in 1990 or later), so there is an opportunity to investigate whether recent users at this level had other reasons for introducing computers than schools that were more or less forerunners (started in 1988 or before).

From Figure 3.1, one may infer that recent starters tend to emphasize more *keeping the curriculum and methods up-to-date* as reason for introducing computers (all figures are higher than those for schools which started earlier). As for the other reasons, the figures are not consistent across countries. Noteworthy, is that in Greece the recent users have more pronounced reasons than the forerunners, especially for *making school more interesting*, while in Japan the reverse is the case for most reasons. In Austria, *having an opportunity to acquire computers* is relatively unimportant as a reason to introduce computers (see also Table 3.1) and recent users attach very little importance to it.

In which subjects are computers used?

Results from Stage 1 of this study showed that almost all computer using schools use computers for computer education courses (Pelgrum & Plomp, 1991 and 1993). An interesting question is to what extent computers are used in 'existing' subjects. In order to shed light on this, the computer coordinators of schools were asked to indicate how many teachers of the subjects mathematics, science, mother tongue, and social studies used computers for instructional purposes. Table 3.2 contains for secondary schools the average percentages computer using teachers, showing that in most countries there is at least one subject in which a substantial percentage of teachers use the computer.

For elementary schools, Table 3.2 reflects the percentage of computer using schools in which the computer is used for teaching subject matter. This is because, in elementary schools, the above mentioned subjects are generally not separate formal courses with specialized subject teachers.

Table 3.2

Percentage computer using elementary schools (grades 4, 5, 6) with at least one teacher using computers to teach subject matter. Average percentage of computer using teachers by subject in computer using schools at lower secondary level (grades 7, 8, 9) and upper secondary level (grades 10, 11, 12)

	Elementary Schools			Lower Secondary Schools							Upper Secondary Schools						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
A.	74	84	89	59	39	45	10	56	40	56	31	32	27	52	23	32	49
B.	49	21	75	22	14	31	7	54	35	48	M	12	25	50	34	32	48
C.	39	82	92	43	3	24	0	23	27	45	7	4	4	22	10	6	43
D.	39	84	76	5	4	15	0	27	19	33	5	2	7	24	11	11	26

Notes: M = number of valid cases too small (<30).

Data source: computer coordinators, except USA lower and upper secondary level (principals).

The original wording of the subjects is:

A. Mathematics;

B. Science;

C. Mother tongue;

D. Social studies.

In elementary schools, computers are used most in teaching mathematics, followed by mother tongue/social studies and finally science. In Japan science comes before mother tongue/social studies.

Information from the Dutch National Research Coordinator indicates that for **elementary schools** the percentages are inflated. This is probably due to the fact that respondents who did not answer the question were removed from the calculation of percentages in Table 3.2. If one would count these responses as signifying non-use the percentages for mathematics, science, mother tongue, and social studies would be respectively 48, 32, 26, 26 for Japan, 75, 19, 74, 76 for the Netherlands, and 72, 61, 75, 61 for the USA.

In lower secondary schools, computers are used most by mathematics teachers. However, in lower secondary schools in Japan, the percentages for mathematics and science are almost the same. In upper secondary schools for most countries, the percentages for mathematics and science are virtually the same, with the exceptions of Bulgaria (higher for mathematics) and Latvia (higher for science).

For mother tongue and social studies (such as history, geography, economics), the percentages of teachers that use the computer in secondary education are generally lower than those for mathematics and science. Across countries, the highest percentage is alternately found for mother tongue or social studies, thus the subjects can't be ranked.

A word of caution for the interpretation of the results of Table 3.2 should be made here. The figures don't indicate to what extent (that is, how often) computers are used in school subjects. Similarly there is no indication here how many students actually use the computer.

Table 3.3

Change between 1989 and 1992 in average percentage of computer using teachers by subject in computer using schools at secondary level

	Lower Secondary Schools				Upper Secondary Schools		
	AUT	GER	NET	USA	AUT	IND	USA
Mathematics	+	.	+	.	.	-	.
Science	.	+	+	.	M	-	.
Mother tongue	+	.	+	.	.	.	.

Notes: - = >15% decrease, . = no major change, + = >15% increase, M = number of valid cases too small (<30).

In order to compare the percentages presented in Table 3.2 with similar estimates from the 1989 survey, Table 3.3 shows for countries (for which both estimates are available) to what extent the infusion of computers in some common subjects at secondary level changed since 1989. Displayed are major increases, major decreases, and no major changes.

From Table 3.3 it can be concluded that the growth in computer use mainly takes place in lower secondary schools. The results also indicate that the use of computers in subjects other that computer education courses drastically declined in India. This finding is explained by recent changes in policies with regard to computer use in schools which are placing more emphasis on computer education than on applications in subjects. Also here, a word of caution is needed. Some further analyses in the Netherlands (ten Brummelhuis, 1993) indicate that increased use of computers in subjects is mainly caused by the fact that in more schools a single teacher started to use computers for instructional purposes, rather than that more teachers within schools adopted computers for instruction.

While the statistics reported above indicate the use of computers at school level (namely in terms of percentages of teachers using computers for a certain subject), the question remains to what extent students, at the target grade level, use computers in school subjects.

Table 3.4 provides a completely different picture of the situation with regard to computer use in subjects than Table 3.2.

Table 3.4

Percentage of students at target grade level in computer using schools who used computer at school in school year 91-92 and percent of students who used computers 10 or more times in certain subjects (when subject was taken and computer was used during the school year)

	Elementary Schools			Lower Secondary Schools							Upper Secondary Schools						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
A.	51	67	93	90	52	78	96	49	78	95	87	81	40	52	80	73	96
B.	17	18	51	71	52	81	71	10	86	67	84	84	51	73	86	90	83
C.	5	21	28	7	13	15	9	2	7	7	2	5	20	2	4	3	6
D.	1	8	5	2	5	M	8	2	M	2	1	4	13	5	2	3	4
E.	1	24	10	5	6	9	8	1	7	9	0	4	8	1	2	0	9
F.	3	22	10	1	M	M	7	1	12	3	0	3	8	1	0	0	2

Notes: M = number of valid cases too small (<250) or too many missing cases (>20%).

The original wording of the computer use/subjects is:

A. Computer used;
B. Computer education;
C. Mathematics;
D. Science;
E. Mother tongue;
F. Social studies.

In Table 3.4 one may observe that a clear majority of students in computer using schools used a computer at school in the school year 1991-1992 (except in Bulgarian lower secondary schools, Japan, and India) but that they hardly use computers frequently in the 'existing' school subjects. In elementary schools also, only a small group of students report use in computer education lessons. In lower and upper secondary education, most of the computer using students use computers only frequently for computer education courses (except for Japanese lower secondary schools).

Just a small percentage of students used the computer 10 or more times in a school year in mathematics, science, mother tongue or social studies. In these four subjects, student use prevails in mathematics, except in the Netherlands (elementary and lower secondary schools), Japan (upper secondary schools) and in the United States of America (lower and upper secondary schools).

From the above we may infer that, in 1992, *learning about computers* was still the most important way students were involved in information technology, rather than *learning with computers*. The question arises what topics students learn when they learn about computers.

The content of teaching about computers

There are several ways to describe the content of computer education. One way is to take the **intended curriculum** (reflected in the syllabus or textbooks) from a country as a source. This was done (in 1990) during the pilot stage of the project, and it was found that the uncertainty and variety in what should be taught is very great. Clearly, the domain of computer education was not yet defined; it appeared unfeasible in 1990 to describe for the countries in the study the intended curriculum for computer education.

A second way for describing the content of a curriculum is by taking the **implemented curriculum** (that is the content of teaching in the classroom) as the reference. This was done at a *global level* by asking teachers to indicate which topics they taught in computer education lessons and at a *specific level* by requesting teachers to rate whether the content of the items used in the Functional Information Technology Test (which was administered to students, see next chapter) was taught before the date of testing.

Implemented curriculum (global level)

Table 3.5 contains the percentages of teachers (in 1989 as well as in 1992) who indicated for each main topic, whether it had been taught in computer education lessons during the school year. For elementary education, these teachers are not necessarily specialized computer education teachers. Only teachers that provided data for the target grade level students were selected. These data were not collected in the USA in 1992. A more detailed list of main topics as well as subtopics is contained in Appendix 5.

Table 3.5

Topics taught about in computer education lessons (during school year 1988/1989 and 1991/1992) - Percent computer using (computer education) teachers checking main topics

	JPN		NET		USA
Elementary Schools	89	92	89	92	89
Computer & society	39	35	20	27	27
Applications	74	79	47	60	39
Technical matter topics					
Problem analysis & programming	32	14	10	5	21
Principles of hard-/software	31	14	19	13	29

	AUT		BUL	GRE		JPN		NET		USA
Lower Secondary Schools	89	92	92	89	92	89	92	89	92	89
Computer & society	93	96	84	98	96	40	47	68	78	78
Applications	100	100	87	93	94	81	81	95	100	95
Technical matter topics										
Problem analysis & programming	88	89	95	96	91	53	37	56	48	71
Principles of hard-/software	85	95	52	93	99	48	44	72	83	72

	AUT	BUL	IND		JPN		LAT	SLO		USA
Upper Secondary Schools	89	92	89	92	89	92	92	89	92	89
Computer & society	83	91	71	77	71	69	79	89	89	71
Applications	85	94	91	93	78	79	99	96	97	86
Technical matter topics										
Problem analysis & programming	96	94	83	88	87	78	95	98	87	66
Principles of hard-/software	89	65	85	91	83	72	89	91	89	77

From Table 3.5 one may observe that in elementary schools 'technical matter' and 'computer & society' topics are hardly taught, while the percentages for 'applications' are quite high. In secondary schools the percentages are generally quite high. Since 1989, there is a slight trend that teaching about programming is taking place less frequently (especially in Japan, the Netherlands, and Slovenia), although the percentages are still quite substantial. On the other hand teaching about applications is becoming slightly more popular (but increased substantially in elementary schools in the Netherlands). An explanation for this might be that there is a decreasing need to be able to program a computer in order to handle computer-related tasks (Anderson & Collis, 1993), while general applications, like word processing, database applications and spreadsheets are becoming increasingly userfriendly and easy to handle.

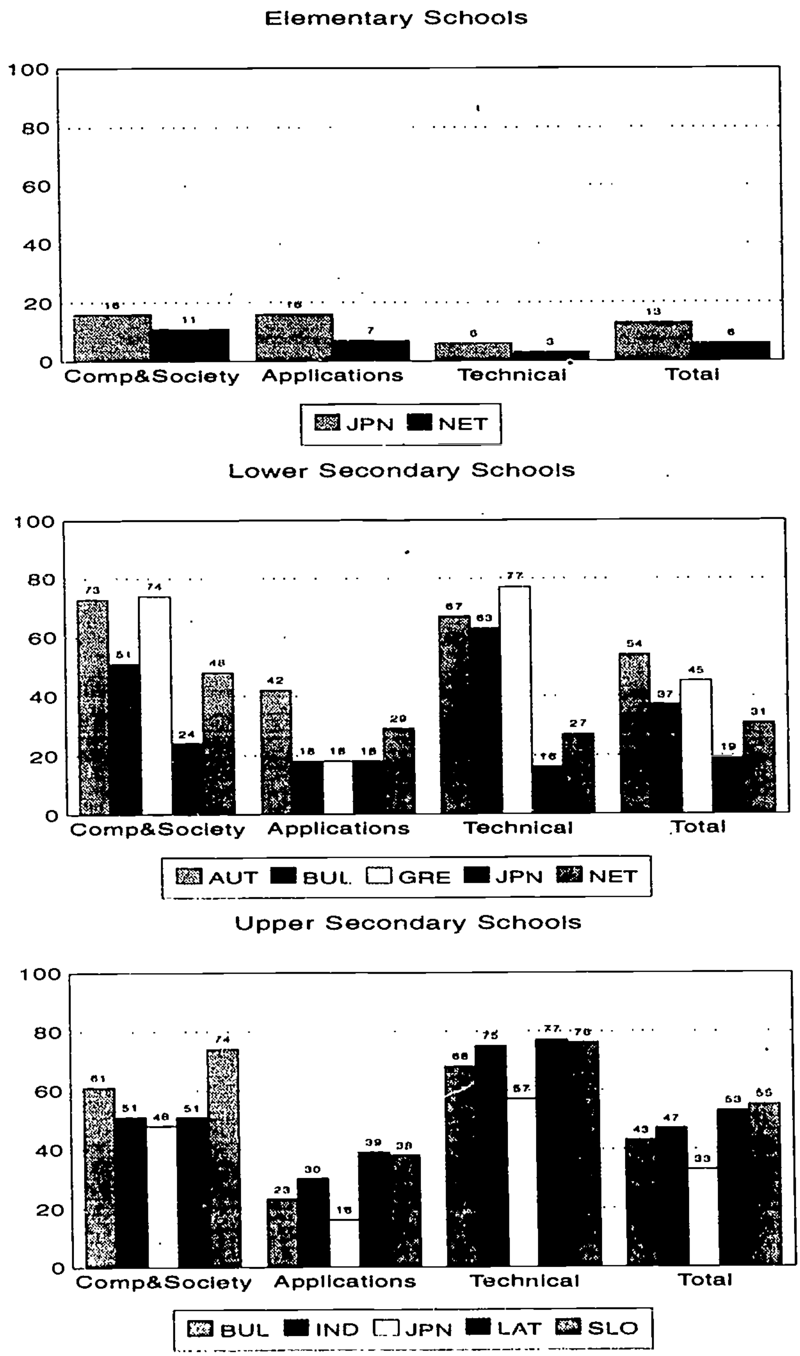
Since 1989, teaching about the topic 'computer and society' increased in about half of the participating countries but, within this main topic, teaching about the ethical issues of computer use increased in all countries (see Appendix 5).

The remark of Davis (1993) that the low percentage of schools dealing with ethical issues such as copyright and privacy is troublesome, still holds, but attention for this topic seems to be increasing. Some more information about ethical issues, related to computer use, can be found in Chapter 4.

While Table 3.5 only takes into account whether teachers cover the main topics, Figure 3.2 offers more details about the percentage of subtopics taught for each of the main topics.

From Figure 3.2 one may infer that in elementary education the coverage of topics relating to technical matter and computer & society, is low (which is not surprising given the age of the students and the character of the topics). This is also the case for teaching applications for which a high percentage was reported in Table 3.5.

The percentages in lower and upper secondary education are higher than in elementary education. When looking at the percentage taught for the total list of topics, one may note that in Austrian lower secondary schools and in Latvian and Slovenian upper secondary schools, there was a relatively high coverage of all topics. They are followed by Indian upper secondary schools. In secondary schools, much attention apparently is given to technical matters (principles of hardware and software or programming), except in Japanese lower secondary schools and in the Netherlands.



Notes: Technical = principles of hard-/software and programming.

Figure 3.2 Average percentage of topics taught by computer using (computer education) teachers in computer education lessons (during school year 1991/1992).

Although the previous figures offered some insight into the coverage of computer related topics, they did not provide an indication of how much time is spent on each topic, nor of the relative emphasis on each of them. Table 3.6 contains some further statistics with regard to this issue.

Table 3.6

Average percentage of lesson periods spent by computer using (computer education) teachers in computer education lessons (during school year 1991/1992)

	Elementary Schools		Lower Secondary Schools					Upper Secondary Schools				
Percent of time spent on:	JPN	NET	AUT	BUL	GRE	JPN	NET	BUL	IND	JPN	LAT	SLO
Computer & society	4	14	5	6	8	5	8	5	9	6	4	5
Applications	62	59	67	33	47	59	76	47	44	32	56	62
Word processing	15	18	23	8	28	21	26	14	10	13	14	22
Data base management	7	0	10	1	10	4	15	7	6	1	12	17
Spreadsheets	2	1	15	1	1	3	10	4	5	6	10	10
General applications	32	27	12	20	3	23	12	21	14	6	11	6
Technical applications	0	0	7	3	0	2	3	1	2	1	1	1
Other applications	5	13	0	0	6	6	10	0	8	4	8	7
Technical matter topics	3	3	27	54	40	12	15	45	46	51	35	29
Problem analysis & prog.	2	1	19	49	22	9	5	37	29	41	30	19
Principles of hard-/software	2	2	9	6	18	4	10	8	17	9	5	10

Notes: In computing the total time spent as base for the percentages, missing data were considered to be zero. This will inflate the percent of time spent on topics, but is evenly spread across countries.

Table 3.6 shows that, in elementary schools, most of the time in teaching about computers was spent on applications (mainly word processing and other general applications). In secondary schools, much time is spent on this topic also, but at this level a relatively large percentage of lessons was devoted to technical matters as well. In upper secondary schools in Japan and India, and in secondary schools in Bulgaria, programming and principles of hardware and software constitute a major part of teaching time.

Implemented curriculum (specific level)

Teachers of students to whom the Functional Information Technology Test (FIT-test, see Chapter 4 for a description of the content of the test) was administered, were asked to indicate for each item in the test whether the subject matter covered in the item was taught before the date of testing (roughly the end of the school year 1991/1992). These items concern basic understanding of both hardware and software terminology as well as general applications like word processors and spreadsheets. The percent of teachers indicating that an item was taught gives an indication of the opportunity students had to learn the item. The percentage of items taught before the date of testing gives an Opportunity to Learn (OTL) index. Table 3.7 shows that a word of caution about the OTL-information is needed.

Table 3.7

Percentage of students for whom OTL-information is available and OTL-information is not available and percentage of students in each group who followed a computer education course (CE) during the school year

	OTL available		OTL not available	
	Percent Students	Percent had CE	Percent Students	Percent had CE
Elementary				
NET	91	22	9	27
USA	98	59	2	M
Lower Secondary				
AUT	83	55	17	69
BUL	56	24	44	11
GER	50	51	50	36
GRE	97	94	3	M
JPN	98	10	2	M
NET	92	53	8	60
USA	95	56	5	M
Upper Secondary				
AUT	90	62	10	65
BUL	76	76	24	70
IND	11	44	89	1
JPN	100	27	0	M
LAT	96	72	4	M
SLO	42	68	58	36
USA	96	42	4	M

Notes: M = number of valid cases too small (<250).

Unlike traditional subjects like mathematics which is compulsory for all students in almost all educational systems, computer education courses do not exist in all schools. If these courses exist, they are quite often optional. Therefore it was not always possible to collect OTL-information for all students taking the FIT-test. Table 3.7 shows that for a substantial percentage of students in Bulgaria, Germany, India, and Slovenia the OTL-information is missing. If none of these students attend computer education courses the OTL-estimates for a country would be seriously inflated. Table 3.7 shows that this is indeed the case in India, which is plausible due to the large percentage of students in non-using schools. It occurs to a lesser extent in Bulgaria, Germany, and Slovenia for which the estimates are probably just slightly inflated.

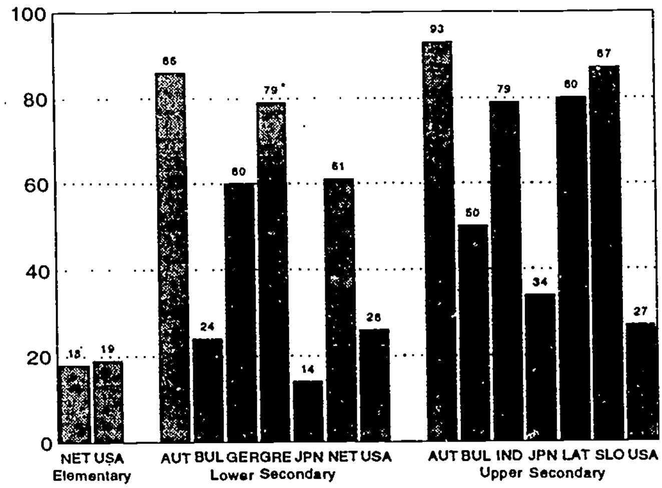
For Greece the sample consists only of students in computer using schools. Therefore, the OTL-index is not so much an overestimation for the sample but rather for the total population.

Another word of caution should be that in the USA the OTL-questionnaire deviated from the international format. It included a filter question indicating that the OTL-questions were only applicable if all or nearly all students in the selected class (had) attended computer education courses. However, in-depth analyses showed that "the OTL-information from the USA is valid and useful" (Anderson, personal communication).

With these remarks in mind, Figure 3.3 shows the Opportunity to Learn (OTL) indices averaged per country. OTL-information, disaggregated to the student level, for each separate item of the test can be found in Appendix 6.

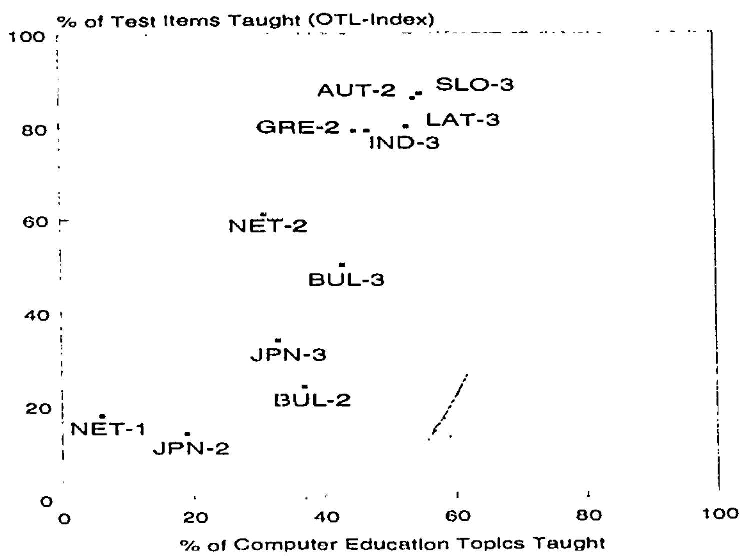
One would expect the percentage of test items taught to students to increase as they go through successive stages in their education, and indeed in Figure 3.3 the highest percentages (within countries) are found at the upper secondary level. Japan and the United States of America have relatively low Opportunity to Learn indices for both lower and upper secondary levels.

A plot of the global and specific measures of content coverage (Figure 3.4) shows that, at country level, the information from the global and specific measures are quite convergent: Austria, Greece, India, Latvia, and Slovenia have a high coverage of computer education topics, while the coverage is extremely low in elementary schools in the Netherlands and in lower secondary schools in Japan.



Notes: * = inflated estimate, only for computer using schools.

Figure 3.3 Average percentage items from Functional Information Technology Test, judged by teachers as taught before the date of testing (OTL-index).



Notes: The number behind the country abbreviation indicates the population: 1 = elementary, 2 = lower secondary, 3 = upper secondary education.

Figure 3.4 Plot of global and specific content coverage measures for country means.

Types of computer use by students at and outside school

In Chapter 2, the percentages were shown of students who used the computer in and/or outside school. The kind of computer related tasks these students perform is reviewed here. Students at the target grade level who used the computer at school indicated how often they used it for any of nine different activities. Table 3.8 contains, for each country, the percentage of computer using students that performed computer related tasks 10 or more times during the current school year. As a reminder, the percentage of students that used a computer at all inside school during the school year is displayed in the first row. These percentages are discussed in Table 2.1.

Most intensive use in elementary schools is in playing games (first rank in all three countries), followed by drill & practice, learning new material and word processing (all other ways do not exceed 10% for any country). In lower secondary schools, emphasis is shifted from playing games (first rank in four of the seven countries) towards word processing (first or second rank in six countries) and a mixture of learning new material, doing drill & practice and working on programming assignments (all other uses do not exceed 10% for any country, except in Greece). Upper secondary schools in Austria, India, Japan, and Latvia have, compared to other activities, the most regular use for programming assignments. In Bulgaria and Slovenia, students most frequently mention drill & practice, in the United States of America, word processing. In the latter two countries regular use for programming assignments has a fifth rank.

Across countries, it appears that the most regular use of computers in secondary education is for programming/word processing, followed by learning new material/drill & practice. In upper secondary schools, regular computer use for spreadsheet/data base assignments and laboratory experiments is reported by more than 10% of the students in a few countries. Noteworthy, this is the case for either laboratory experiments (India, Japan) or spreadsheet/data base assignments (Austria, Slovenia, United States of America), not both.

Overall, taking tests is the least regular practiced activity: the proportion of students that used the computer 10 or more times for it exceeds 10% only in Bulgarian and Indian upper secondary schools. This is consistent with results reported by Pelgrum and Schipper (1993), who found, using 1989 data, that school principals also report taking tests to be the least practiced type of computer use.

Table 3.8
Percent of all students that used computer at school in school year 91-92 and percent of computer using students that used computers at school TEN or more times during the school year for different types of activities (all data provided by students)

Elementary Schools	JPN	NET	USA				
Computer used at school	19	62	93				
Learning new material	2	9	17				
Doing drill & practice	5	19	17				
Laboratory experiments	1	3	2				
Writing/Wordprocessing	3	7	13				
Programming assignment	4	3	6				
Spreadsheet assignment	0	7	3				
Data base assignment	0	1	2				
Taking tests	0	5	9				
Playing games	13	20	53				
Lower Secondary Schools	AUT	BUL+	GER	GRE	JPN	NET	USA
Computer used at school	90	39	77	96 *	32	77	95
Learning new material	17	17	31	28	2	34	13
Doing drill & practice	3	20	22	17	1	19	14
Laboratory experiments	1	5	9	15	1	5	1
Writing/Wordprocessing	24	10	37	32	2	23	21
Programming assignment	15	17	23	28	2	17	11
Spreadsheet assignment	8	2	3	6	1	8	7
Data base assignment	4	2	5	17	1	10	5
Taking tests	2	4	8	10	1	6	4
Playing games	27	22	17	7	8	14	34
Upper Secondary Schools	AUT	BUL+	IND	JPN	LAT	SLO	USA
Computer used at school	87	79	8	49	80	68	96
Learning new material	31	35	23	21	29	21	16
Doing drill & practice	2	51	18	12	33	35	18
Laboratory experiments	5	9	20	16	4	2	3
Writing/Wordprocessing	28	27	18	25	20	27	28
Programming assignment	44	40	31	39	43	20	15
Spreadsheet assignment	13	6	5	7	7	12	12
Data base assignment	13	7	9	5	7	12	8
Taking tests	2	11	12	3	8	3	5
Playing games	23	23	22	13	41	26	25

Notes: * = students in computer using schools only, + = >20% missing values for most activities, but national research coordinator stated that these can be seen as 'not done'.

Table 3.9

Percent of all students that used computers outside school during school year 91-92 and percent of computer using students which used computers outside school THREE or more times during last 2 months for different types of activities (all data provided by students)

Elementary Schools	JPN	NET	USA
Computer used outside school	50	77	88
Schoolwork	5	8	15
Other learning	8	17	23
Word processing	10	24	20
Programming	4	12	M
Spreadsheet	3	8	7
Data base	2	7	7
Draw/painting	19	29	32
Playing games	43	77	62

Lower Secondary Schools	AUT	BUL+	GER	GRE	JPN	NET	USA
Computer used outside school	69	29	75	56 *	37	76	76
Schoolwork	8	7	11	21	6	14	21
Other learning	9	12	14	26	7	12	15
Word processing	27	13	39	36	17	30	24
Programming	17	18	26	33	7	17	M
Spreadsheet	9	5	5	16	5	7	6
Data base	7	5	11	24	3	10	5
Draw/painting	37	26	39	37	10	20	22
Playing games	75	74	79	62	39	76	53

Upper Secondary Schools	AUT	BUL+	IND	JPN	LAT	SLO	USA
Computer used outside school	68	20	6	39	30	52	78
Schoolwork	30	23	21	9	15	21	27
Other learning	4	17	33	7	18	14	11
Word processing	52	24	31	24	26	29	29
Programming	31	31	43	18	45	20	M
Spreadsheet	12	9	16	5	9	15	5
Data base	14	12	16	3	14	16	5
Draw/painting	33	32	24	10	32	31	14
Playing games	60	66	47	43	75	64	42

Notes: * = students in computer using schools only, + = >20% missing values for most activities, but national research coordinator stated that these can be seen as 'not done'.

Similar to the rating of activities inside school, students at the target grade level who used the computer outside school indicated how often they used it for any of eight different activities. Table 3.9 gives results for activities performed 3 or more times with the computer outside school during the last two months. The proportion of students who used a computer at all outside school during the school year is displayed in the first row and is discussed in Table 2.1.

With first rank in each country and level, playing games is clearly a very popular activity when computers are used outside school. Drawing/painting and word processing come next with respectively nine and seven (joint) second ranks. In all three countries at the elementary level, four of the seven at lower secondary and two of the seven at upper secondary level, drawing/painting has a second rank.

In countries where drawing/painting has a second rank, word processing has rank three in six of the nine countries. From elementary to upper secondary level drawing/painting is apparently less practiced in favour of, in the first instance, word processing.

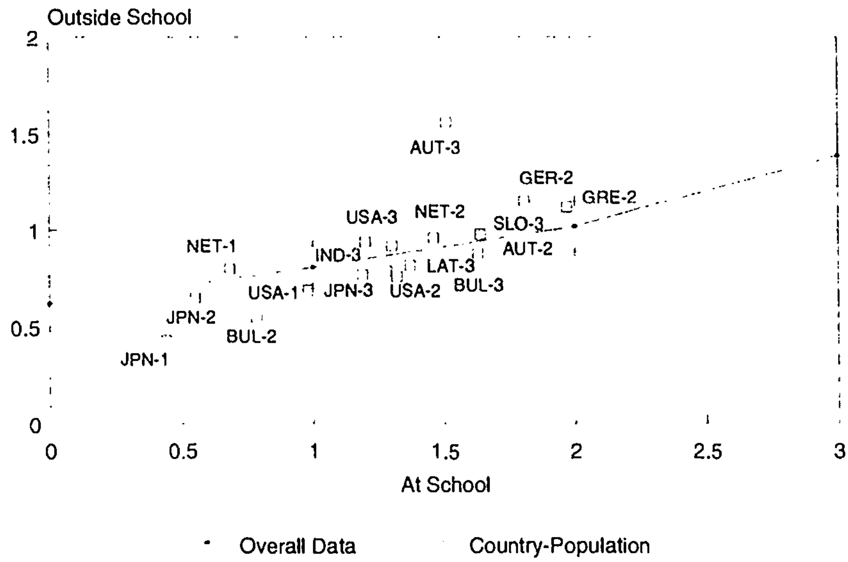
At the secondary level, the frequency of programming is higher than of doing schoolwork/other learning, at elementary level programming is less practiced than these activities. Programming is practiced frequently by a substantial proportion (more than 1/3) of students at upper secondary level in India and Latvia.

Within countries it can be seen that doing schoolwork tends to increase, going from elementary to upper secondary level whereas using the computer for other learning tends to decrease. Working with spreadsheets and data bases are the overall least practiced activities.

It is unclear to what extent working with applications, programming or even playing games outside school are part of doing schoolwork or other learning. Or, in other words, to what extent is the use of computers outside school enhanced or motivated by what is done or learned at school? To get some insight into this question, correlations were computed between the frequencies of the activities performed at school with the frequencies of activities outside school. This was done for word processing, programming, working with spreadsheets and data bases and playing games (these activities are mentioned for both inside and outside school, see Tables 3.8 and 3.9). For a first confirmation that activities outside school are enhanced by what is done at school, correlations between matching pairs of activities (for example programming inside - programming outside) should be higher than for other combinations of activities.

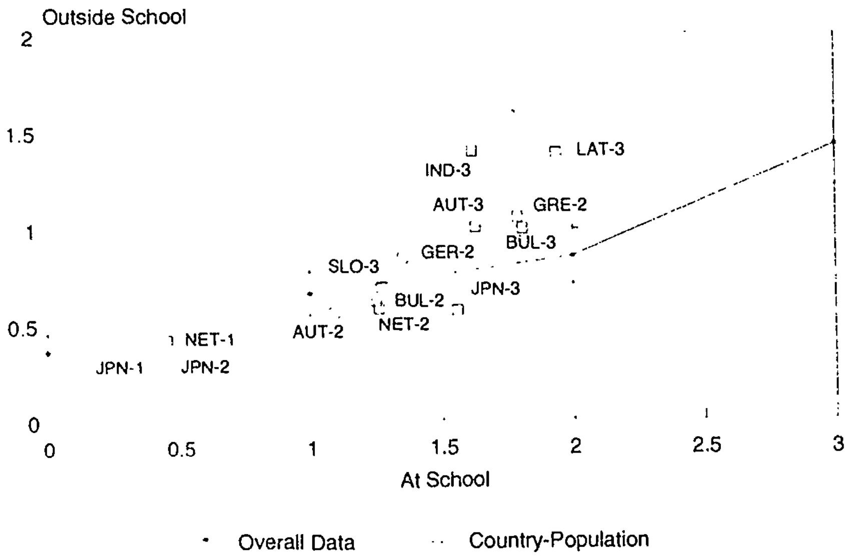
The results showed that the activities inside and outside schools are correlated. At the elementary level, the correlations between matching pairs of activities ranged from 0.19 to 0.31 with a median of 0.24, while for the other combinations, it ranged from 0.04 to 0.20 with a median of 0.11. For the lower secondary level, the ranges were 0.17 to 0.29 (median 0.27) and 0.02 to 0.19 (median 0.14). For the upper secondary level, the ranges were 0.27 to 0.39 (median 0.34) and 0.06 to 0.25 (median 0.14). The highest correlations are found for matching pairs. For the other combinations, the highest correlations are found in all three populations (0.20, 0.19 and 0.25) for the use of two related types of programs: (data base inside/spreadsheet outside) or (spreadsheet inside/data base outside). These results lead to the tentative conclusion that the use of computers at school is not an isolated activity restricted to the school, but tends to transfer to the way computers are used outside school.

As an example, the relationship for use inside school and use outside school is further illustrated in Figures 3.5 and 3.6 for word processing and programming.



Notes: + = 95% confidence interval, the number behind the country abbreviation indicates the population: 1 = elementary, 2 = lower secondary, 3 = upper secondary education.

Figure 3.5 Plot of frequency of doing word processing at school and outside school for overall data and country averages.



Notes: + = 95% confidence interval, the number behind the country abbreviation indicates the population: 1 = elementary, 2 = lower secondary, 3 = upper secondary education.

Figure 3.6 Plot of frequency of doing programming at school and outside school for overall data and country averages.

Summary

The results presented above show that over a period of three years, changes can be observed in the way computers are used in schools. Although the major emphasis is still on learning about computers, there are indications that the application of computers in existing subjects is slowly increasing. On the other hand, it is quite obvious from the data that computers are far from being a tool for regular use in the daily school live of students: not only are very small numbers of students using computers regularly, but also (especially in secondary education) computers tend to be used mostly for 'office' applications like word processing and hardly for learning new material. In the context of the wish of schools to give students experience they might need in the future, it is interesting to observe that the computer activities of students at school and outside school are related.

4

What Do Students Know, Learn and Think about Computers?

The importance of learning about computers

The previous chapter showed that learning about computers is one of the major ways through which students acquire experience in schools with new information technology. This is important because using computers and computer applications require a certain amount of basic knowledge and skills with regard to the functioning of computers and software packages.

Everyone acquainted with applying computers for certain tasks knows that there is almost no end to what can be learned about computers. Just like in the field of medicine, where not everyone who wants to live healthy needs to become a doctor, for surviving with computers, one does not need to be a computer specialist. Rather, students need to have certain generic knowledge (for example of hardware components and software packages) and should understand some basic principles of how to operate computer equipment of different types, such as how to switch on a machine, how to start a program, how to store information, what a mouse is, etc. However, how much and what kind of knowledge and skills students need to have is difficult to determine, especially in an international setting like the Comped study.

Devising an international test for measuring basic computer knowledge and skills was a difficult problem, as will be explained in the next section.

Besides certain knowledge about and skills in handling computers, self-confidence and interest are important elements for developing a basic attitude of adapting to changes and for lifelong learning about new information technologies.

In this chapter we will first describe how students' knowledge and attitudes with regard to computers were measured and next we will present some results.

This chapter was written by Willem J. Pelgrum and Tjeerd Plomp.

The construction of the Functional Information Technology Test (FITT)

A starting point for developing any test for measuring students knowledge and skills is a clear definition of intended educational outcomes. Once such definitions are available, test items can be constructed which operationalize what students are expected to do in order to show that they have achieved the goal. From a curriculum-analyses, which was conducted in 1990, it was learned that there is hardly consensus within as well as between countries with regard to the definition of computer related goals. It was therefore decided to draw very heavily on expert opinions when constructing an international test. The test construction procedure can be summarized as follows (from Anderson & Collis, 1993):

> *Rapid technological change and the lack of consensus on goals of computer education impedes the establishment of stable curricula for "general computer education" or computer literacy. In this context the construction of instruments for student assessment remains a challenge. Seeking to anticipate and measure what educators will view as the essential computer- related abilities for students in the mid-1990s, the second stage of the IEA Computers in Education Study developed a student assessment instrument grounded in the perspective of "functionality," student prerequisites to functioning effectively with practical information-related tasks. The threat of test obsolescence as well as philosophical differences among the experts in their goals for general computer education challenged traditional test construction procedures. The resulting content objectives and test procedures can serve as guidepost's for research and planning in computer education.*

Table 4.1 summarizes the content of the so called Functional Information Technology Test (FITT). The 30 item test was the same for lower and upper secondary schools, and the first 17 items constituted the test for elementary schools. Due to translation errors, items 17, 18, and 23 were excluded from the calculation of a total test score for lower and upper secondary education.

Table 4.1
Items in the Functional Information Technology Test with reference to content-domain

Number	Item content	Content-domain
1.	Dialling a telephone number is an example of input.	Concepts
2.	Sorting names of authors is an example of processing.	Concepts
3.	BASIC, PASCAL and LOGO are programming languages.	Concepts
4.	The physical parts of a computer is called hardware.	Concepts
5.	Create own software by writing programs.	Concepts
6.	Mouse used for entering instructions into computer.	Concepts
7.	Computer program = instructions to control computer.	Concepts
8.	Does very small multi-media computer already exist?	Concepts
9.	Data stored on disk.	Concepts
10.	Permanent storage device computer program.	Concepts
11.	What with program if computer switched off.	Concepts
12.	Device giving text you can see and read?	Concepts
13.	Why back-up copy on another diskette needed?	Computer handling
14.	Interpret instructions on a computer screen.	Computer handling
15.	Why persons may need different word processing programs?	Computer handling
16.	What is a copy-protected disk?	Computer handling
17.	How re-start computer after freezing?	Computer handling
18.	How fix problem with wordprocessor?	Applications
19.	Which program useful for keeping track of store budget?	Applications
20.	Which possibility open in networked computer lab?	Applications
21.	Interpret menu of a word processing program for saving?	Applications
22.	Interpret menu of a word processing program for re-start?	Applications
23.	Which program suited for similar letters to several people?	Applications
24.	Interpretation of spreadsheet screen.	Applications
25.	Interpretation of database screen.	Applications
26.	Storage device for long periods of time.	Concepts
27.	How load data from storage?	Concepts
28.	Why password code needed?	Computer handling
29.	Effect when printer is "off-line".	Computer handling
30.	What does a cursor do?	Computer handling

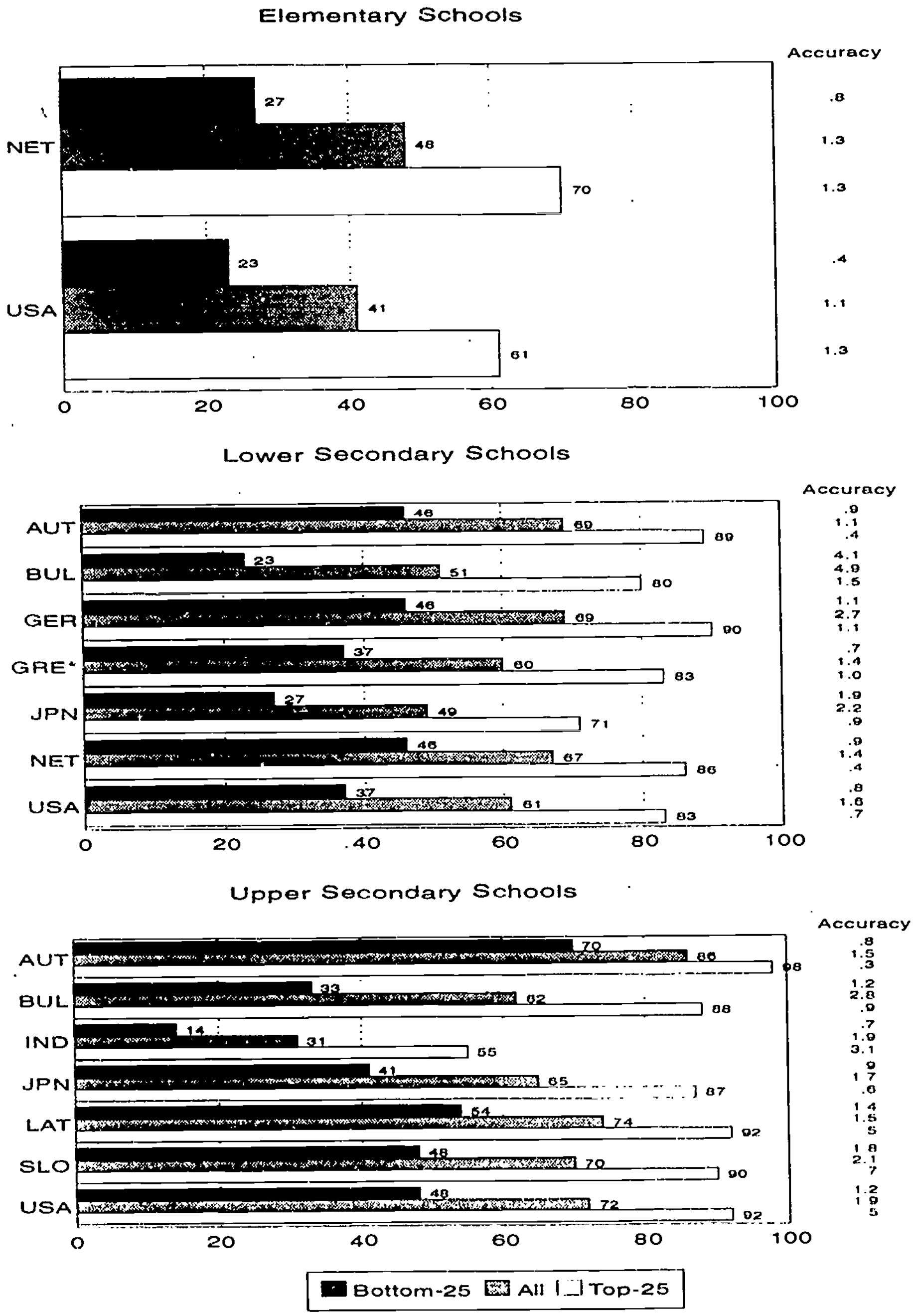
In order to help determine the quality of the test, reliability coefficients were calculated. These, together with item statistics, like percentages of students choosing an answer alternative are shown in Appendix 6. The test reliability for the 17 items test in the USA for elementary schools is moderate. For the 27 item test, the reliabilities are higher and acceptable for analysis purposes.

Some further analyses were conducted for determining to what extent the test is a fair test. Some indication for fairness may be gained by comparing the relative difficulty of items across countries. These comparisons showed that some items are relatively much more difficult in one country than in the other countries. In addition, one may observe in Appendix 6 that 'opportunities to learn' the content covered in each item are quite different between countries. Hence, these indicators show that the test is not fair to the extent that all students had a chance to learn the subject matter. This is what could be expected based upon the lack of convergence in the curriculum analyses results referred to above. Moreover, it is not uncommon to find these kind of differences in international comparative studies: for instance, in the Second International Mathematics study, a majority of students from lower secondary schools in some countries had an opportunity to learn about the Pythagorean theorem, while this was the case in only 2% of the Japanese schools. Moreover, as shown in Chapter 2, one may not expect that the test is fair for all students because there are considerable differences between students in term of use and access to computers. What does this mean for the interpretation of the test scores? The major implication is that test scores should not be interpreted as an effect of learning in school. Rather they are a result of the total experience with and exposure to computers within as well as outside school. Therefore, in order to reflect the contribution of these different learning contexts, beside giving estimates of the test and attitude measures for the total sample of students in each country, these estimates will also be broken down within countries by subgroups of students with different exposure to computers.

Knowledge of students and opportunities to learn

The average score for the total sample in the target grade level and for the 25% highest and lowest scoring students as well as the accuracy for estimating the score for the total target population in a country (95% confidence) are displayed in Figure 4.1.

In elementary schools in the Netherlands and the USA, the FITT-scores are low.



Notes: * = inflated estimate, only students in computer using schools; accuracy = the sample mean plus/minus this value gives the 95% confidence interval for the population mean based on jackknifed standard error estimate.

Figure 4.1 Average percentage correct per country and educational level for all students in the target grade level (see also Table 2.1 for percent access) and highest/lowest 25%.

However, although the OTL-index (see Chapter 3) suggests that there is hardly any teaching about the content covered in the test, the scores indicate that students have learned something, because the average score is well above chance level (which is about 25% correct). For the 25% highest scoring students in Dutch elementary schools, the average percentage correct is 70%, which is well above the average score for lower secondary school students. This also holds if the score calculation is based on the 17 items administered in elementary schools.

In lower secondary education, the highest scores for the total sample occur in Austria, Germany and the Netherlands. Greece (with an inflated estimate) and the USA holding an intermediate position, while Bulgarian and Japanese students (with on the average 51 and 49% correct) score the lowest. This trend is the same for the scores of the 25% lowest and highest scoring students. Except for Bulgaria and Japan, the bottom 25% of the students score well above chance. Chapter 3 showed that the OTL-index differs dramatically between countries varying from less than 20% in Japan to about 90% in Austria.

In upper secondary education, the Austrian students have a very high average score on the total test. Latvia, the USA, Slovenia, Bulgaria, and Japan are in a middle position, while the scores for India are quite low, which is not surprising given the large number of students in the sample without exposure to computers. At this level of education, one may also observe great differences between countries with regard to opportunity to learn (see Chapter 3).

Chapter 6 shows that, in all countries, boys score higher than girls. Although in some countries these differences are negligible (for instance, in the USA) in other countries the differences are sizable (for instance in Austria). In Chapter 3, it was shown that the Opportunity to Learn index differed quite substantially between countries. Moreover, in some countries OTL data were not available for all students. Therefore OTL and FITT scores cannot be compared directly because in some countries OTL is available for all students and in other countries only for a part of the students. Still, the question is of interest whether the trends as shown in Figure 4.1 are different if one calculates FITT-scores for those students for whom OTL information is available. Table 4.2 shows that these trends are the same. Moreover, this table shows that a high OTL score for a country does not guarantee high FITT scores (see for instance Greece and India).

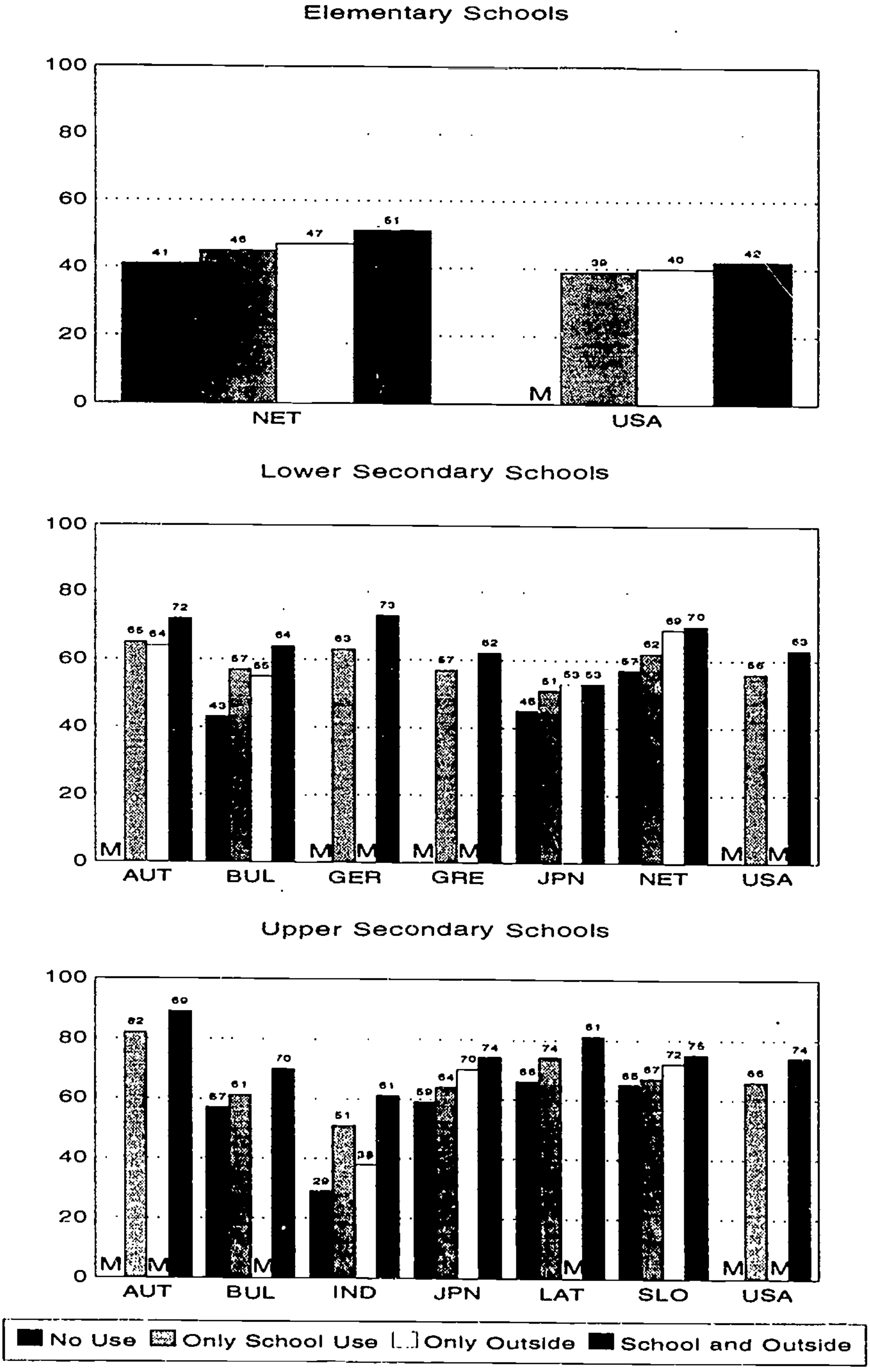
As indicated above, these average FITT scores of students give an indication of the level of understanding of technology by students in a country and not necessarily what they learned in school.

Table 4.2
Average percentage Opportunity to Learn (OTL) and average percentage correct on the FIT-test only for students for whom OTL information is available

	OTL	FITT
Elementary		
NET	18	48
USA	21	41
Lower Secondary		
AUT	85	69
BUL	22	54
GER	55	68
GRE	79	59
JPN	12	50
NET	58	67
USA	28	60
Upper Secondary		
AUT	94	86
BUL	47	62
IND	81	50
JPN	34	65
LAT	82	75
SLO	87	70
USA	19	73

As was shown in the Chapter 2, not all students, except in the USA, had access to or used computers. In some countries (like Bulgaria, India, Japan, and Slovenia) relatively large groups of students do not use computers at all in school. This means that these students did not have a chance to learn about computers at school. Still they may have learned about computers outside school (at home, together with friends or via hobby clubs) or in other ways (television, movies, reading, etc.).

Figure 4.2 shows the average FITT scores of 4 groups of students, namely those using computers: (1) at school and outside school, (2) only at school, (3) only outside school, and (4) not at all.



Notes: M = number of cases too small (n <250).

Figure 4.2 Percentage correct on FIT-test for four categories of student use.

It is interesting to note that students without any access to computers still score considerably above chance level (which is about 25% correct answers) in answering the test (the only exception is India). This is not uncommon in international tests as factors like general intelligence may also play a role in test performance, but also some students may have had access to computers in previous school years.

The differences between the groups in Figure 4.2 are quite consistent. In most countries, students using computers at school and outside school have the highest score, followed by students who use computers only outside school. The lowest scores are for students who use computers only at school or not at all. The relatively low score of India for the total sample in Figure 4.1 is also largely explained by Figure 4.2; students using computers in school have much higher scores than those who don't and although the scores of these groups are still low compared with Austria, they are at about the same level as the total sample in Japan and the USA.

Although students using computers only outside school tend to score somewhat higher than students using computers only at school, from a further inspection of the data it seems likely that factors like family welfare and social economic status of the parents (factors associated in most assessments with the performance of students) play a role in accounting for this difference. From a perspective of equity, this observation provides an argument for stimulating computer use at school. On the other hand, it may be that students who use computers at home are much more motivated and interested in learning about computers. Results shown in the attitude part of this chapter will shed more light on this question.

Finally, after the presentation above of rather crude test measures we would like to refer the reader who is interested in more detail to Appendix 6, which contains for each item in the test per country item statistics and breakdowns by gender and categories of student use.

The construction of the student attitude scales

It is well known from previous research that motivation and interest of students play a role in learning and achievement. Although the exact nature of this role is still debated (which one is the cause?), attitudes are important elements of a disposition towards learning. Especially with regard to computers, it may even be more important to develop a readiness in students towards learning about computers than to impart certain quickly outdated specific knowledge and skills in handling computers.

The construction of the attitude scales for students took place according to the following steps:

1. Collection of attitude items from a large number of sources.
2. Categorization of items in conceptually homogeneous categories.
3. Judgement of relevance of items for international scales (wording, culture specificity, translatable).
4. Selection of items for pilot testing.
5. Analyses of pilot test results for defining international scales.
6. Selection of items for three scales: Enjoyment, Relevance and Parental Support with regard to computers.

Table 4.3 contains a short description of the content of each of these scales. Appendix 7 contains, for each attitude-item, detailed statistics per country and also the scale reliabilities per country. This appendix shows that, in general, the reliabilities of the scales Enjoyment and Relevance are satisfactory. The scale Parental Support, which only contains 2 items, has, not surprisingly, lower reliabilities and should therefore be interpreted with some caution.

Table 4.3
Attitude items per scale

Relevance
Computers can help me to learn things
With computers possible to do practical things
Computer useful for future career
Knowing how to use computers worthwhile skill
All students should have an opportunity learn computers
Computers important for being informed citizen
With computer skills better jobs
Enjoyment
I like to talk to others about computers
Computers can be exciting
I like reading about computers
Computer job very interesting
Computer lessons favorite
Want to learn a lot about computers
Like to scan computer journals
Stop usually for computer shop
Computers interest me little
Parental Support
Parents encourage computer use
Parents want me to be good at working computers

Students' perception of the relevance of computers

Figure 4.3 contains, for each country, the average percentage agreement of students with items in the different attitude scales.

In general, students think positively about the *relevance of computers*, as the average percentages in most cases are well above 50%. Japanese elementary school students are less positive about the relevance of computers than Dutch students.

In lower secondary schools, the students are very positive about the value of computers. Japanese students are least positive.

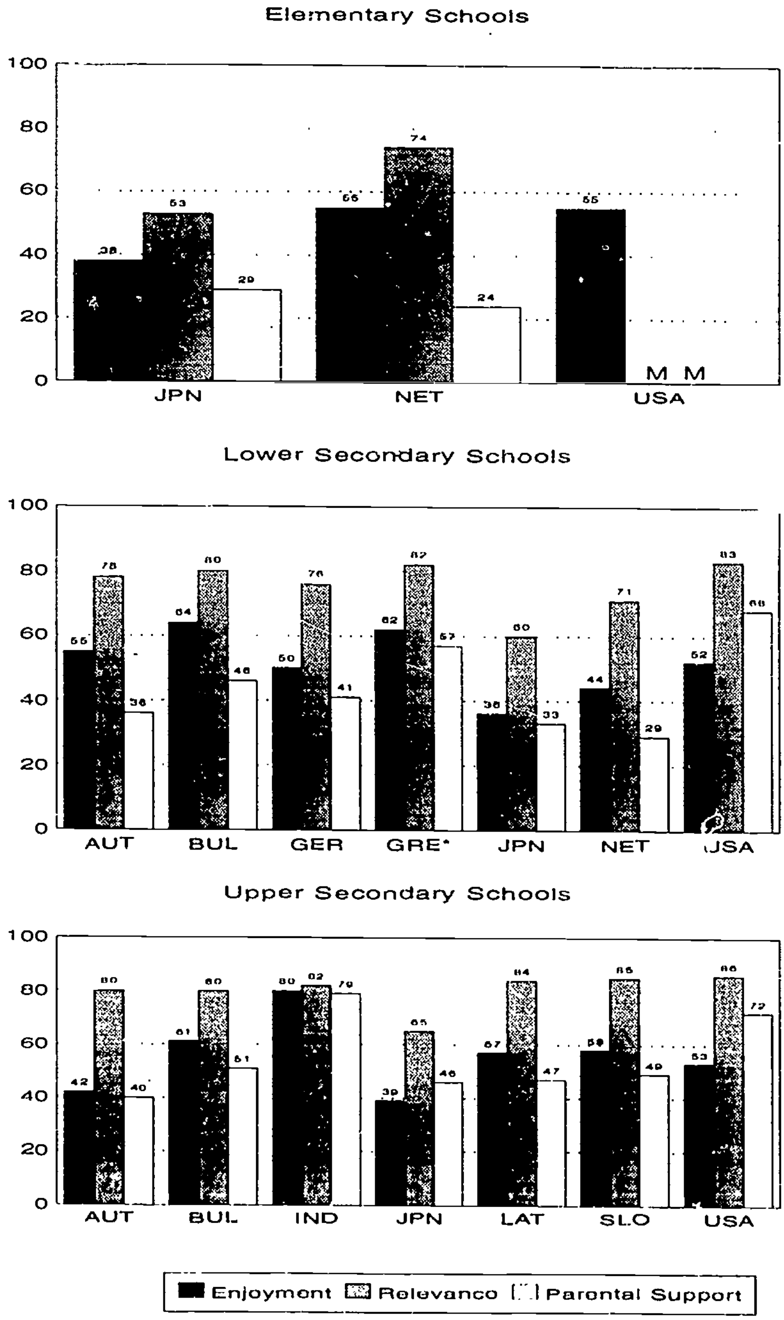
In upper secondary schools, on average, there is more than 80% agreement with the items in the relevance scale, while this is less (65%) for Japan.

Chapter 6 shows that boys tend to agree slightly more with the items than girls, although in the USA, interestingly, this is the other way around. For more details about attitudes of boys and girls, the interested reader is referred to Chapter 6.

Students using computers outside schools and/or at school or not at all have different opinions about the relevance of computers (see Figure 4.4). Students who use computers at schools and/or outside schools, in general, are more positive about the relevance of computers than the students who don't use computers. Students who use computers only outside school or only at school have an intermediate position on this scale.

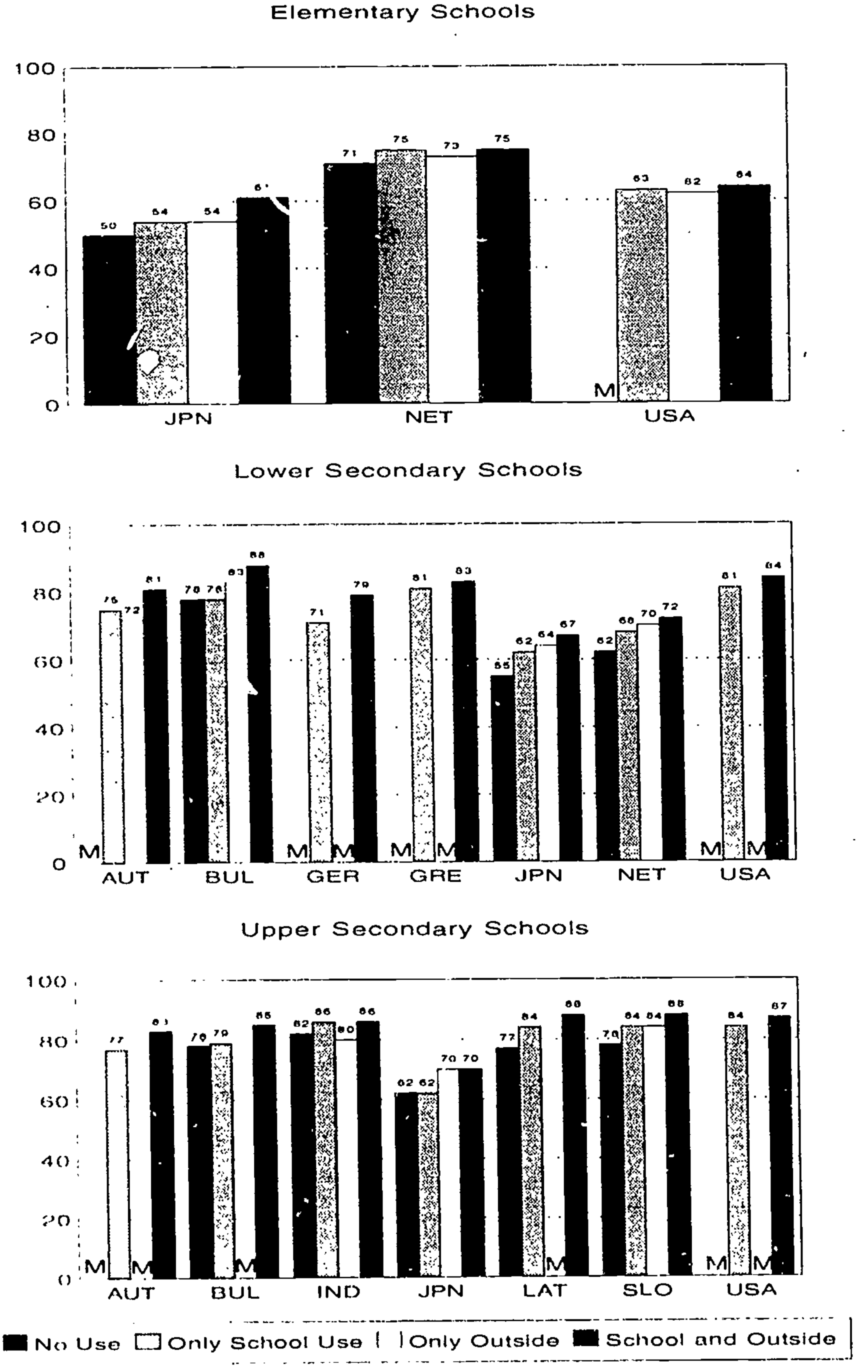
Students' enjoyment in using computers

As indicated in Table 4.3 the scale Enjoyment consisted of items referring to how much students like to work with computers. For elementary schools, a restricted subset of items was used. Analyses have shown that this restriction does not affect any of the trends which will be reported below. As shown in Figure 4.3, the average scale values on the *enjoyment scale* differ greatly between countries. Students in elementary schools in the Netherlands and the USA, lower secondary schools in Austria, Bulgaria, Germany, Greece, and the USA, upper secondary schools in Bulgaria, India, Latvia, Slovenia, and the USA seem to enjoy using computers (the average is above 50%).



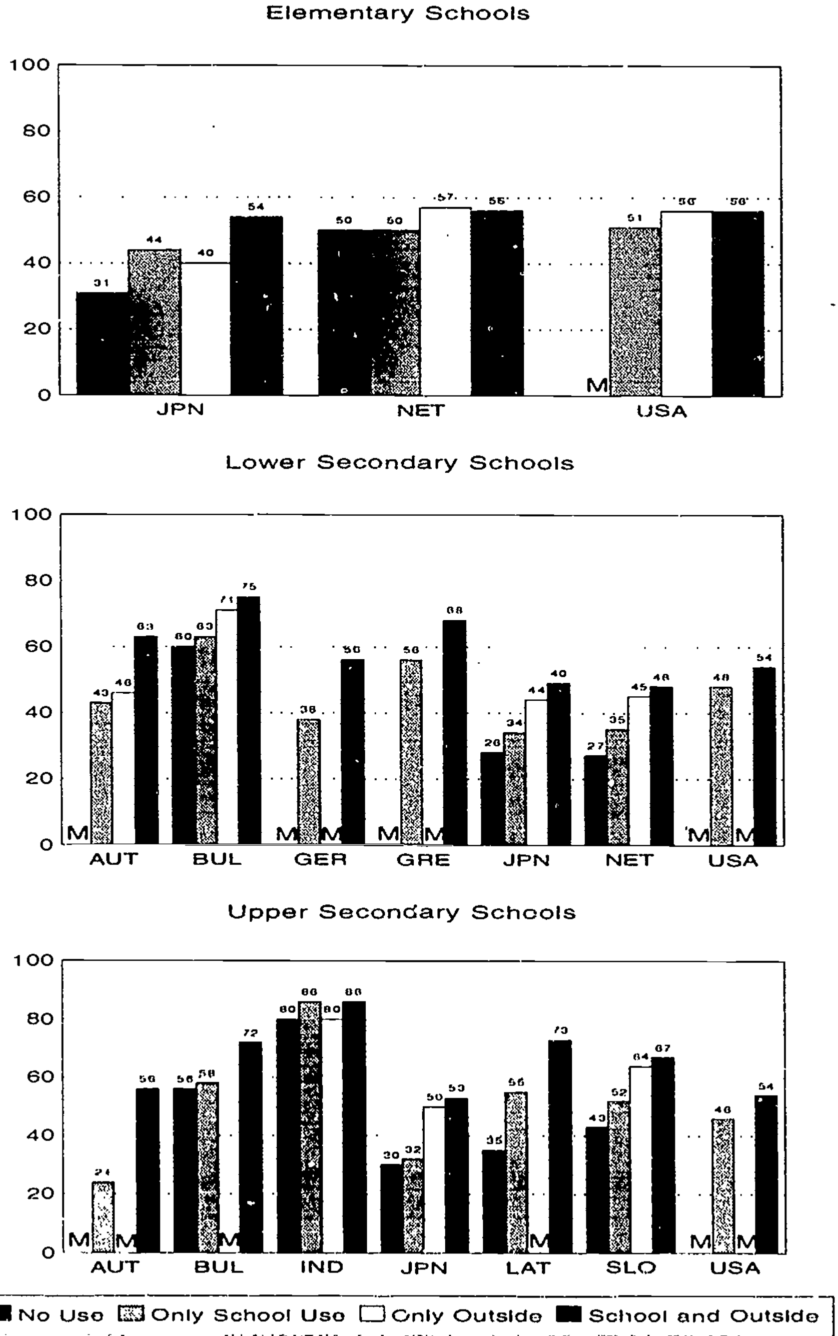
Notes: For elementary schools a reduced enjoyment scale was used; * = only students in computer using schools; Differences between countries statistically significant for enjoyment and relevance (>6%) and parental support (>8%).

Figure 4.3 Mean percentage agreement of students on attitude scales.



Notes: M = number of cases too small (n <250).

Figure 4.4 Mean percentage agreement on relevance scale broken down by student-use groups.



Notes: For elementary schools a reduced scale was used, M = number of cases too small (n <250).

Figure 4.5 Mean percentage agreement on enjoyment scale broken down by student-use groups.

For the students in elementary schools in Japan, lower secondary schools in Japan and the Netherlands, and upper secondary schools in Austria and Japan, the scores are much lower. Noteworthy is the very high score of India (80% in upper secondary schools), and the extremely low score of Japanese lower secondary school students (36%).

Chapter 6 shows that the differences between boys and girls on this scale are quite large as compared to the relevance scale. Thus, boys seem to enjoy using computers much more than girls.

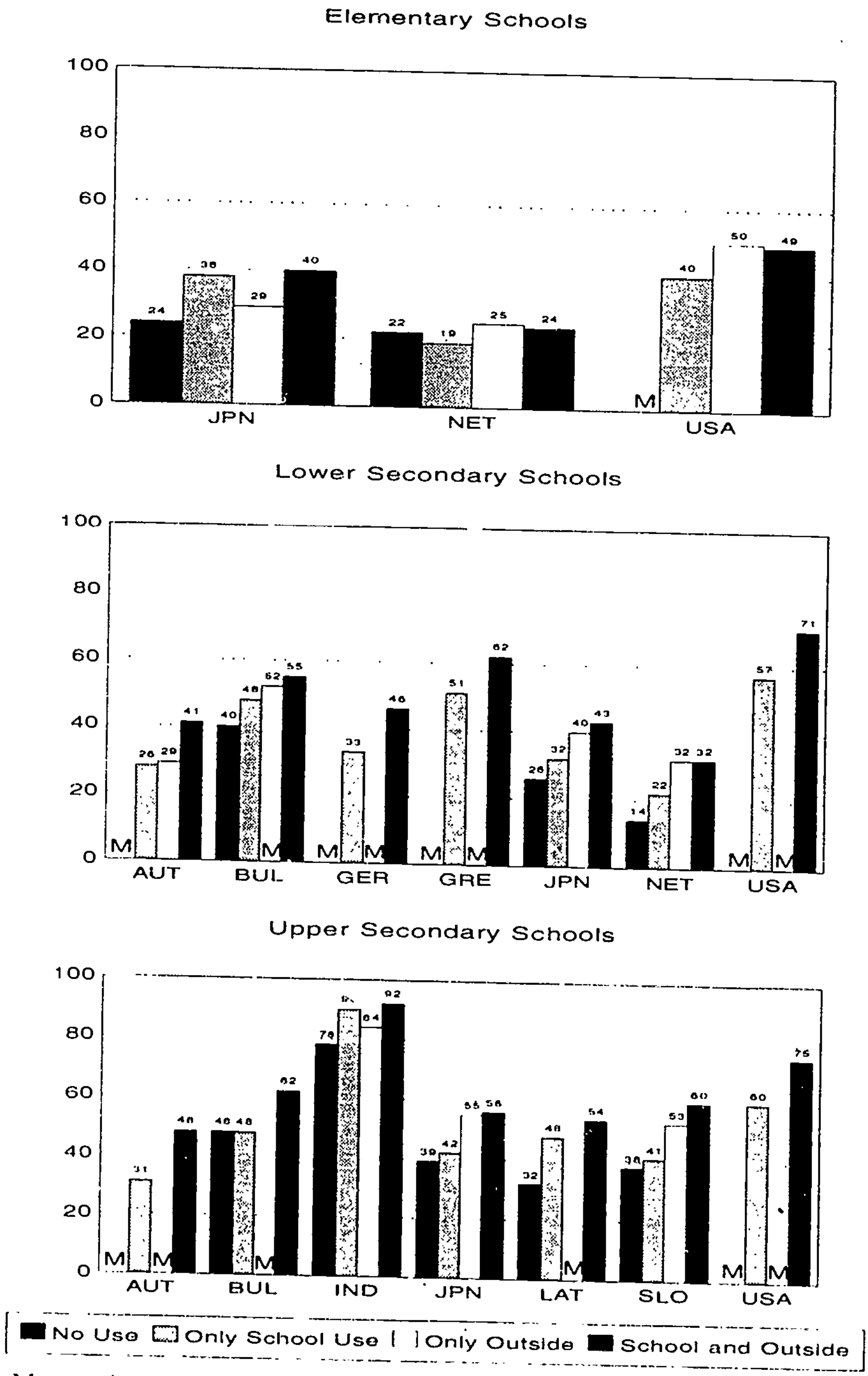
A breakdown by the student user categories (Figure 4.5), shows that the differences between the groups are much higher than for the relevance scale This was to be expected since, for students not using computers, the items are more or less hypothetical. Nevertheless, it is interesting to note in Figure 4.5 the trend that students using computers only outside school enjoy computer use more than students using computers only at school. This may indicate that the first group is more motivated to use computers than the second group. The high scores of India are striking and need to be further investigated.

Parental support

An indication of the extent of parental stimulation for students to use computers can be gained from the scale Parental Support.

The average scores on this scale, shown in Figure 4.3, indicate that most parents in elementary schools in Japan and the Netherlands do not appear to stimulate their children to use computers. Parental stimulation to use computers seems to occur more frequently for lower and upper secondary students, although the average value for lower secondary schools is still low (except for the USA, and Greece), while Austria also has a low score at upper secondary level. Chapter 6 shows that parents tend to stimulate boys slightly more than girls to use computers, except in Japan (more support for girls) and the USA (where the scores are the same).

The breakdown of results by categories of student users (Figure 4.6) seems to indicate that parental stimulation plays a potentially powerful role in the use of computers outside school.



Notes: M = number of cases too small (n <250).

Figure 4.6 Mean percentage agreement on parental support scale broken down by student-use groups.

Ethical issues

In order to explore to what extent students agreed with unethical practices regarding copyright and privacy violation, they were confronted with the following two stories and questions.

Story 1

John bought a computer game. He made copies of the game for three of his friends. Both the program diskette and the game instructions said explicitly that it is forbidden to make copies of the game. John says: "We always make copies. If my friends buy a game, they give me a copy, and I do of course the same. No one ever checked this, so why should I bother?".
Do you agree or disagree with John?

Story 2

Mary and her teacher both bought books from the same store. The store clerk gave Mary a computer listing of all the books her teacher had bought. When Mary's teacher found out, she went very angry to the bookstore and said: "It is my opinion that you should not give the list of my books to anybody. Nobody has the right to know the books I am reading".
Do you agree of disagree with Mary's teacher?

Table 4.4 shows the percentage of students in a country who expressed (slightly or strongly) agreement.

Table 4.4 indicates that quite substantial numbers of students seem to agree with illegal copying of software. Although the percentages of students agreeing with the privacy issue are often quite high, there are still considerable groups of students who seem to deny the right on privacy.

Table 4.4
Percentage of student agreeing with story 1 and story 2

	Story 1	Story 2
Elementary		
JPN	14	72
NET	33	71
Lower Secondary		
AUT	50	69
BUL	26	36
GER	31	68
GRE*	39	49
JPN	39	71
NET	66	72
USA	43	68
Upper Secondary		
AUT	67	76
BUL	35	34
IND	48	46
JPN	52	78
LAT	47	63
SLO	54	61
USA	57	75

Notes: * = only students in computer using schools.

Exposure to computers, test results and attitudes

In the sections above it was shown that test and attitude scores are quite different depending on whether students are using computers and where (at school and/or outside school). As mentioned above, this differentiation of students is a rather crude one, not taking into account the kind and frequency of exposure to computers.

In this section we will examine how students with different degrees of exposure to computers performed on the test and attitude scales.

The construction of an exposure-index

In the background questionnaire for students a number of questions were asked about the frequency of computer use for certain activities at school and at home (such as drill and practice, writing, and programming) and in school subjects.

Altogether these were 28 separate items for which students could choose the answers: not at all, once or twice, 3-9 times, 10 or more times, respectively coded as 0, 1, 2 and 3. The exposure index was calculated by summing all the 28 items (maximum score is 84) and by categorizing students in terms of low exposure (score 0-8), medium exposure (score 9-25), and high exposure (score >25). Next, for each group in a country the test results and attitude-scores were calculated.

Student exposure to computers and test results

Figure 4.7 shows the average percentage correct responses on the FIT-test for the low, medium and high exposure groups of students in each country.

In elementary education, the differences between the groups are hardly noteworthy.

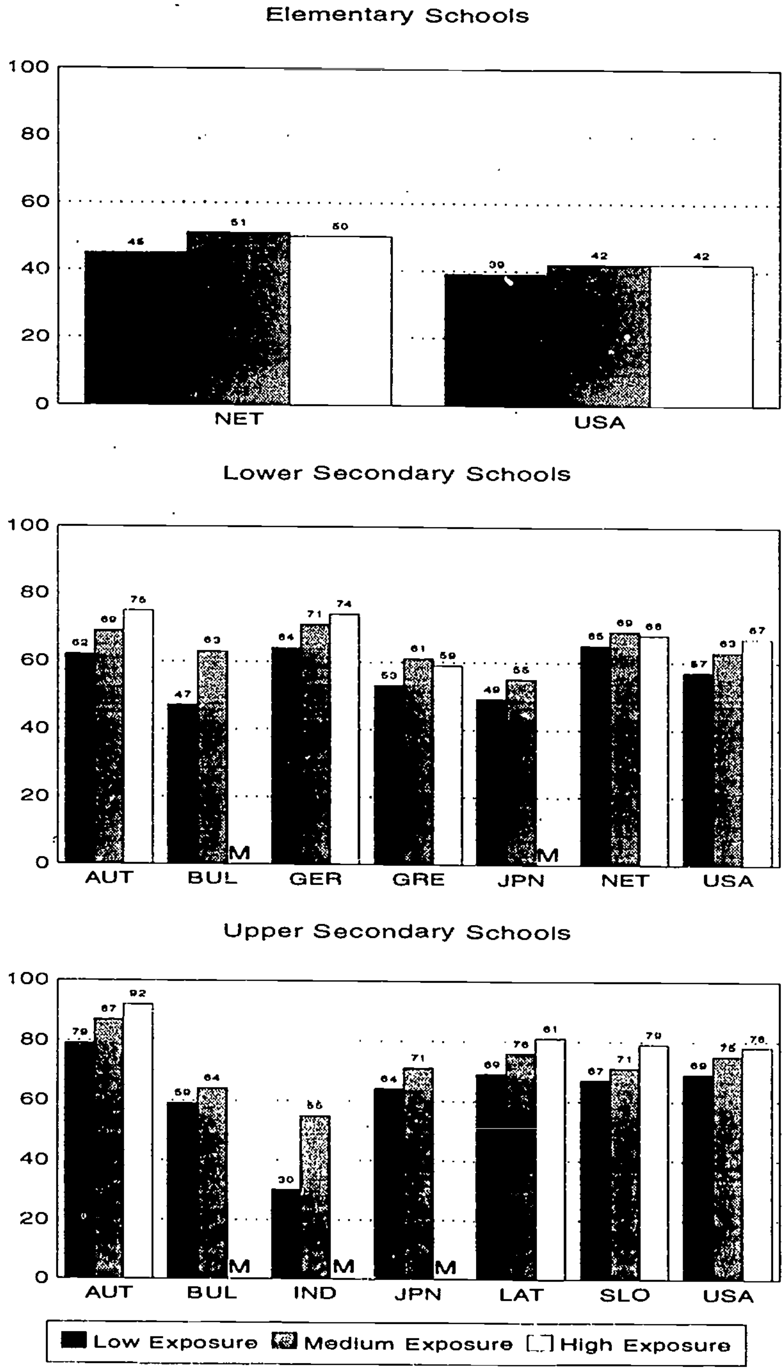
In lower secondary education, the differences between the low and high exposure group vary between 3-6% in Greece and the Netherlands, 9-10% in Germany and the USA and 13% in Austria.

In upper secondary education, the differences are especially noteworthy between the low and medium exposure group in India, while in other countries the trends are comparable with lower secondary education.

These results indicate that the more students are exposed to computers the more their generic knowledge of information technology is fostered.

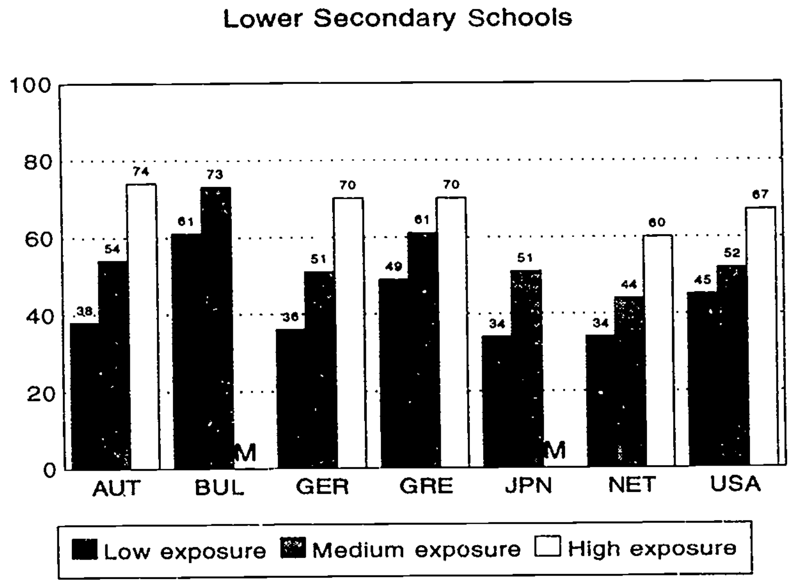
Student exposure to computers and attitudes

Figure 4.8 shows that students in the high exposure groups enjoy the use of computers much more than students in the low exposure groups. The scores in the former group are often twice as high as in the latter group. This indicates that enjoyment is a potentially powerful factor in promoting students involvement in using computers.



Notes: M = number of cases too small.

Figure 4.7 Average percentage correct scores on FIT-test broken down by student-exposure groups.



Notes: M = number of cases too small.

Figure 4.8 Mean percentage agreement on enjoyment scale broken down by student-exposure groups.

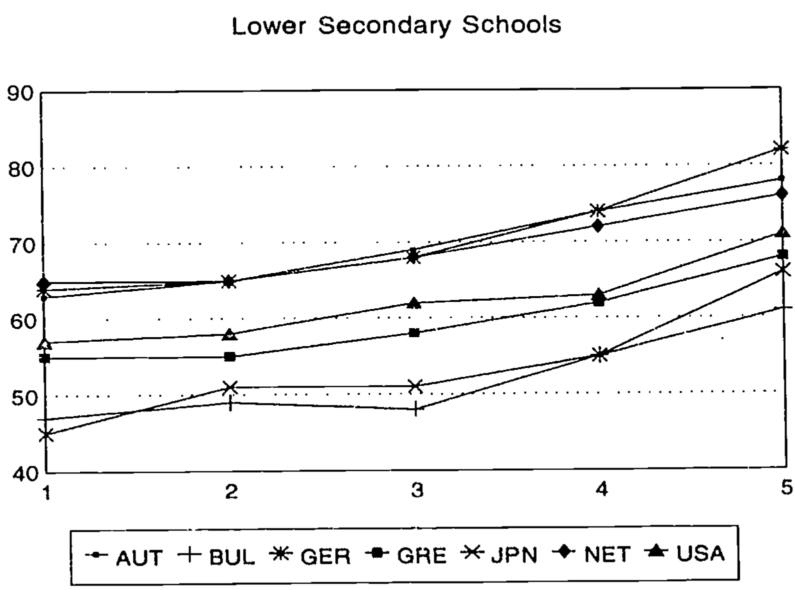


Figure 4.9 Average scores on FIT-test (y-axis) broken down by student enjoyment in using computers (x-axis).

Student enjoyment to use computers and FITT-scores

The educational research literature as well as common sense suggests that people enjoy activities in which they are good or, the other way around, they are good in activities which they enjoy.

Figure 4.9 illustrates that this also tends to be the case with regard to computers: students who enjoy using computers have higher scores on the FIT-test than students who are less enthusiastic about using computers.

Concluding remarks

The results shown in this chapter suggest that in many countries improvements with regard to basic computer related knowledge might be achieved. The observation that the FITT-scores are quite high in countries in which schools heavily emphasize students understanding of computers and software (such as Austria and Germany) might function especially as a mirror for other countries. Likewise, the results as reported in Chapter 6 suggest that gender differences are not a natural phenomenon which cannot be changed.

On the other hand, the fact that the use of computers at school does not seem to have a great added value (in terms of general knowledge about computers) to outside school experiences with computers should probably in many countries be taken as a stimulus for rethinking the goals, contents and didactics of computer related curricula.

5

Educating the Educators: Training for Teaching about Computers

As was reported in Chapter 3, learning about computers is the major way in which students acquire knowledge and skills in this field. In many countries, learning about computers takes place within a separate subject (often called computer education). In other countries, this type of learning takes place within the setting of a subject like mathematics.

The history of computers and education shows that in many cases, existing subject teachers who were enthusiastic about the new technology were selected to become computer education teachers. But being an enthusiastic hobbyist is not enough for being able to teach students in a new subject. Next to self study activities, in-service education or teacher training was needed and in the 1980s many courses were set up for teachers. This chapter will address the question whether this training provision is sufficient or whether there is a need for more training within this group of teachers and if so, what type of training should possibly be emphasized in future in-service training. Furthermore, the context in which the teacher works, the school environment, will be viewed from the perspective of support for training activities.

In elementary education, usually one teacher is teaching all (or most) subjects to one group of students. If computers have a place within the curriculum, this teacher is mostly also responsible for teaching the students about computers. Therefore, for this population the teacher questionnaire was given to a sample of all teachers in the target grade who are using the computer for instructional purposes. This difference between the populations must be kept in mind when interpreting the data of this chapter. In secondary education, computer education teachers were given a questionnaire. As teaching about computers in the USA most often takes place within other subjects, teacher information was collected in this country via the English teacher. In this chapter we focus on computer education teachers, reason why the USA data are not included in those sections were the teacher perspective is reflected. Also Germany is not included in these sections. The subject computer education is in this country mainly taken place in grade 9 and 10, grades which are not included in this survey.

This chapter was written by Ingeborg Janssen Reinen and Tjeerd Plomp.

Need for training

In order to determine whether there is still a need for training among the group of computer education teachers in secondary school and teachers in elementary school, we studied their knowledge and skills in the field of computers. A conclusion from the 1989 data was that computer education teachers, although having considerable knowledge about and skills in using computers and having learned more about computers than their colleagues in existing subjects, needed more training. The first question to address is whether such developments have taken place during the three years since the first data collection so that this training need has been met. An important indicator for this is the teachers' knowledge and skills in 1992.

Table 5.1
Reliability of the three self-rating scales of teachers using computers for all countries

	Scales		
	Knowledge	Programming	Capability
Elementary Schools			
JPN	.85	.87	.81
NET	.87	.92	.83
Lower Secondary Schools			
AUT	.65	.78	.40
BUL	.60	.41 *	.66
GRE	.67	.64	.60
JPN	.82	.84	.74
NET	.67	.86	.48
Upper Secondary Schools			
BUL	.67	.40 *	.73
IND	.81	.79	.85
JPN	.65	.74	.69
LAT	.59	.50	.43
SLO	M	M	M

Notes: * = this scale has 1 item less as compared to the scale in other countries,
M = information not available or too many missing cases (>20%).

Knowledge and skill level

To measure teachers' knowledge about and skills on how to use computers, three self-rating scales were included in the teacher questionnaire (the complete list of self-rating items is included in Appendix 8):

- knowledge scale: 9 questions about knowledge of hardware and software;
- programming scale: 5 questions about programming skills;
- capability scale: 8 questions about the ability of using the computer as a tool for, for example, word processing and computer assisted instruction.

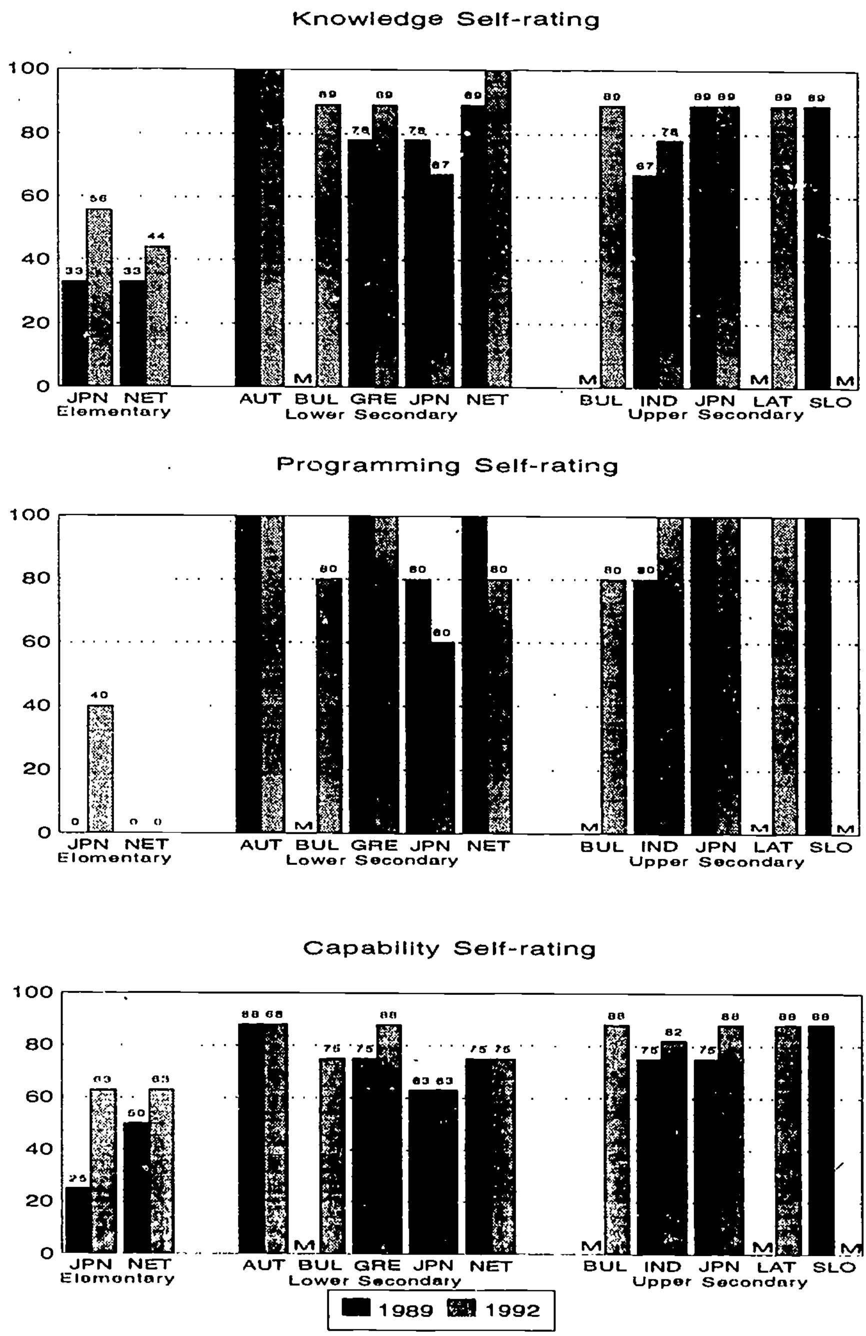
The validity and reliability of these scales were fairly good in stage 1 of the project. As can be seen in Table 5.1, the stage two data show good values.

The results on the three self-rating scales for the computer education teachers in lower and upper secondary education and for all computer using teachers in elementary education are indicated in Figure 5.1.

In lower and upper secondary education, there are a number of countries in which the teachers rate themselves very high on the knowledge scale and the programming scale. In Japan and the Netherlands in lower secondary education, the self-rating on programming has decreased since 1989. A possible explanation might be a decrease in emphasis in these educational systems on programming.

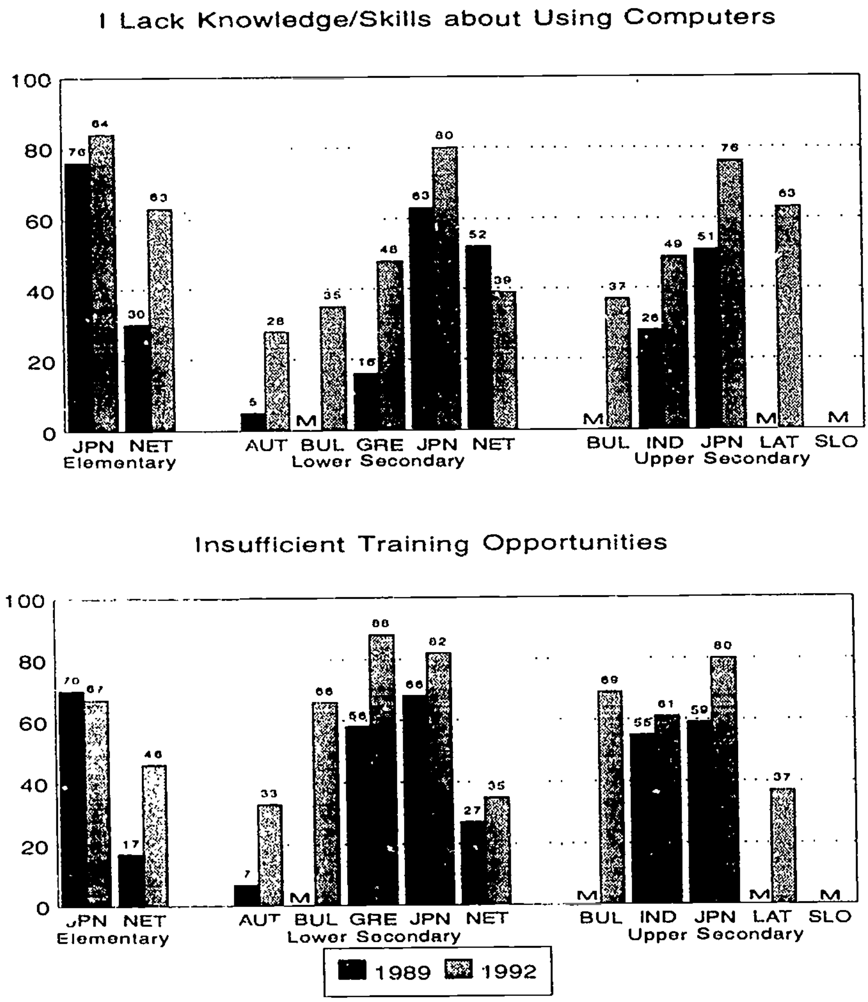
Figure 5.1 shows further that in both countries in elementary education the scores in 1992 are higher on all three scales, which means that teachers, according to themselves, have increased their capability and knowledge during the period of three years. In secondary education, the situation is somewhat more diverse, although Greece and India seem to be the countries with the most changes since 1989. Overall, the most gains for teachers in knowledge and skills seem to have taken place in elementary education but compared to the colleagues in secondary education, the scores on the three self-rating scales are still low.

From the Figure 5.1 it is difficult to determine whether teachers feel themselves prepared enough to work with computers. Although they might rate themselves quite high on the self-rating items, this does not imply that they feel ready to teach students about computers. A look into the wishes of teachers concerning training may possibly shed some light on the amount of 'readiness to teach' about computers.



Notes: M = information not available or too many missing cases (>20%).

Figure 5.1 Median of scores on knowledge and skills self-rating scales (percentage marked items) for (computer education) teachers using computers.



Notes: M = information not available or too many missing cases (>20%).

Figure 5.2 Percent (computer education) teachers indicating training related (minor or major) problems.

Problems experienced

Teachers were asked to mark in a list of possible problems to what extent they experienced them as (minor or major) problems or not at all. The complete list of problems is included in Appendix 9. Two potential problems are important to look at within the perspective of this chapter, namely 'I lack knowledge/skills about using computers for instructional purposes' and 'there are insufficient training opportunities for me'. The results on these two problem items are presented in Figure 5.2.

Although there are some differences between the countries, it is clear that in all populations, Japan is the country in which training related problems are viewed as the most serious. This can easily be explained from the fact that Japan is about to introduce computer education in its national curriculum and therefore, many teachers still need to be trained. In Greece, many teachers indicate a lack of training opportunities. There are training seminars on the use of computers but they are mainly designed for unemployed teachers (as pre-service training) and for teachers of upper secondary schools. Overall, there are quite a number of (computer education) teachers that indicate a lack of knowledge and insufficient training opportunities, and it is noteworthy that these problems seem to have increased in a number of countries since 1989. Although the self-rating scores were quite high, the question on training problems seem to indicate that organizing in-service courses for these teachers needs to be continued in the near future.

Opinion

Teachers were asked for their opinion related to computers. One of the scales in this attitude questionnaire dealt with training need. As such, the results of this attitude scale might provide another indication about the needs for more training.

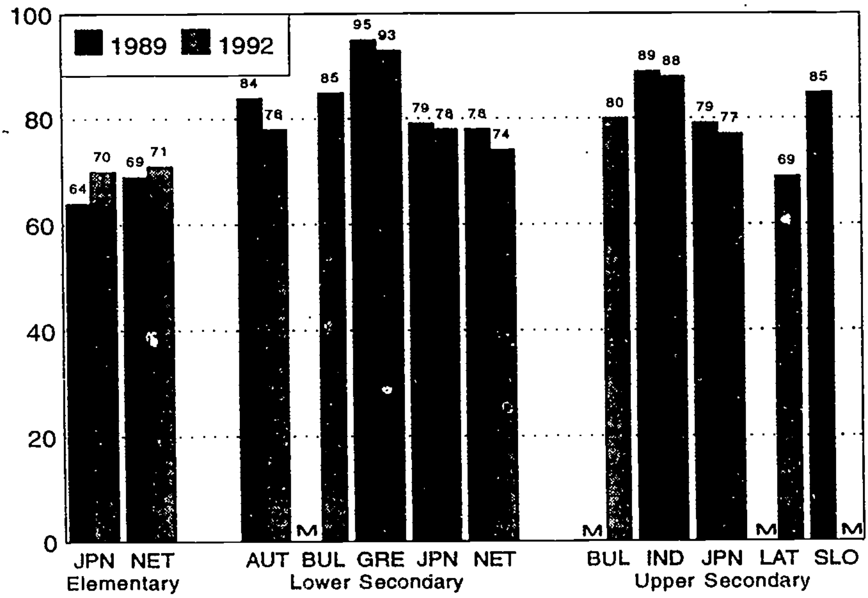
The items of the 'training need' scale are:

(1) I try to keep myself informed about technological changes;
(2) I would like to take part in a computer course to learn more about computers;
(3) In-service training courses about computers should be made compulsory;
(4) I would like to learn more about computers as teaching aids;
(5) I do not mind learning about computers.

The reliability of the training need scale is for elementary education 0.57, for lower secondary education 0.67 and for upper secondary education 0.68.

The results for all countries in the three populations for the attitude scale on 'training need' are indicated in Figure 5.3.

Across countries and populations it is noteworthy that the agreement on the scale 'training need' is high. When comparing the opinions of teachers with the situation in 1989, the conclusion is that the need for training increased in elementary education and decreased a little in secondary education.

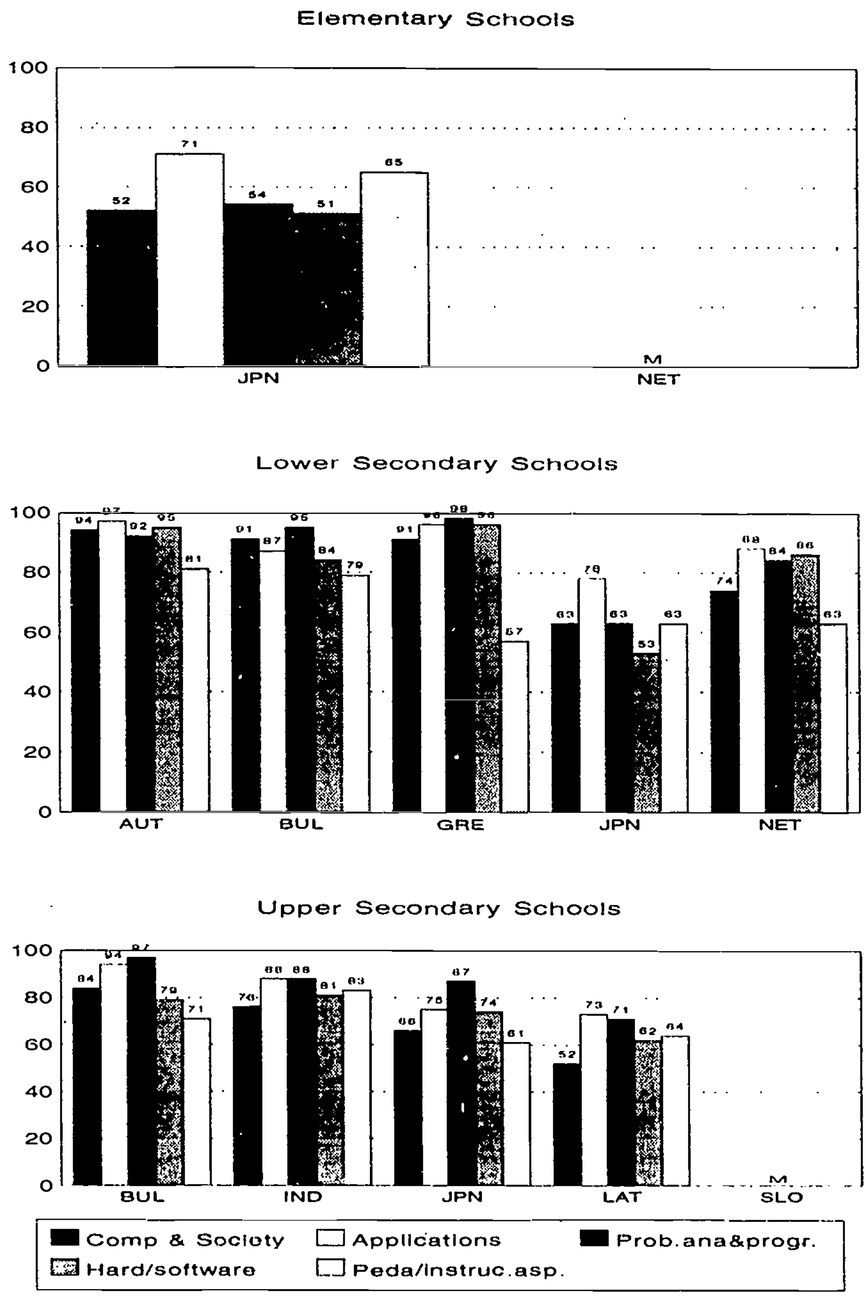


Notes: M = information not available or too many missing cases (>20%).

Figure 5.3 Mean percentage (strongly) agree of (computer education) teachers on the attitude scale 'training need'.

When comparing the results on the attitude scale with the problems listed in Figure 5.2, a high score on the problem 'insufficient training opportunities' in Greece goes together with a high score on the training need attitude scale. But even if there are no large problems experienced with respect to training (such as in Austria in lower secondary education), the need for training is still high.

If we take the self reported knowledge and skills level (see Figure 5.1) into account, (computer education) teachers feel themselves quite knowledgeable and skilful with respect to computers, but they clearly do not think that training is not useful anymore. The conclusion is that continuing attention to teacher training related to computers is necessary. It is apparently not enough that teachers once took part in some kind of training course. This is in line with literature on educational innovations.



Notes: M = information not available or too many missing cases (>20%).

Figure 5.4 Percent (computer education) teachers indicating they have had some form of training for each of the categories.

Training received

In order to find out what type of training would be most useful for (computer education) teachers in the near future, it is useful to know what type of training they have received up till now and how much time they devoted to these training activities.

Topics covered in training

Teachers were asked to indicate in a list of topics what topics were dealt with during teacher training or not. A factor analysis confirmed the existence of the same 5 groups of training topics which were found in stage 1 of the study, namely computers and society (4 items), applications (like word processing, 14 topics), problem analysis and programming (5 items), hard- and software principles (3 topics) and pedagogical/instructional aspects (5 topics). The complete list of training topics is included in Appendix 10. Figure 5.4 shows the results for the 5 categories (without going into details on how many topics per category were covered in the training).

In almost all countries, a majority of the teachers indicate having had some form of training in most of the five categories. Pedagogical and instructional aspects of using the computer is in many cases the category least mentioned as being addressed in teacher training. In secondary education the picture is diverse although, like in upper secondary education, problem analysis and programming seems to be the most important training category in a number of countries. A comparison with the situation in 1989 (see Pelgrum and Plomp, 1991), shows that, only in Japan in elementary education, training in all categories has clearly become more important since 1989. At that time, pedagogical and instructional aspects of computer use was also the category least covered in training in almost all countries in all populations.

The category 'applications' can be split up into so-called 'general applications' (like word processing, containing 6 items, see also Appendix 10) and 'specific applications' (like authoring languages, containing 8 topics). In all countries across the three populations (except for Slovenia in upper secondary education), general applications were clearly more covered in teacher training than specific applications.

When examining each category of training topics for the mean number of topics covered during training, a more complete and detailed picture appears (Table 5.2).

Some countries score not only high on the question of whether training was received in each of the five categories (Figure 5.4), but teachers in these countries also indicate that a large number of topics within these categories were part of training courses (for instance in Austria and Greece).

Table 5.2

Mean number of topics included in teacher training in each category, according to the (computer education) teachers

	Elementary Schools		Lower Secondary Schools					Upper Secondary Schools				
Cat.	JPN	NET	AUT	BUL	GRE	JPN	NET	BUL	IND	JPN	LAT	SLO
CS	1.3	M	3.2	2.3	3.0	1.7	2.3	2.4	2.1	2.1	1.2	M
AP	4.5	M	5.7	4.6	5.6	4.8	5.2	4.7	5.3	4.9	3.8	M
PP	1.5	M	4.0	4.3	4.6	2.0	3.2	4.6	3.6	3.7	2.7	M
HS	1.0	M	2.6	2.0	2.6	1.1	2.2	2.1	2.1	1.8	1.4	M
PI	2.3	M	2.1	2.2	1.7	1.9	1.7	2.2	2.8	2.1	2.2	M

Notes: M = information not available or too many missing cases (>20%).

The explanation of the categories is:

CS: Computer & society (4 topics);

AP: Applications (14 topics);

PP: Problem analysis & programming (5 topics);

HS: Hard & software (3 topics);

PI: Pedagogical/instructional aspects (3 topics).

Before looking at what topics seem to be important for future teacher training courses, the question is addressed whether training received by teachers is, in some way or the other, related to the actual use of the computer in their instructional practice. The same categories of topics used in Figure 5.4 and Table 5.2 to study the teacher training practice, were also included in a question to teachers about what topics are covered in their daily teaching practice in which learning about computers takes place.

Table 5.3 shows what percentage of topics that were taught in (computer education) lessons were covered in teacher training courses.

The results show that a majority of the topics covered in the lessons on computers, were also included in the training courses teachers received. Only Latvia is the exception to this rule. A conclusion from these data could be that the content of (in-service) teacher training is an important reference for what is actually being taught in the (computer education) lessons. However, we cannot conclude from these data that, whatever is being taught in training courses will also be covered in the lessons teachers give to their students.

Table 5.3

Mean percent of topics covered in training of the (computer education) teachers, given the computer topics taught in the class

	Elementary Schools		Lower Secondary Schools					Upper Secondary Schools				
	JPN	NET	AUT	BUL	GRE	JPN	NET	BUL	IND	JPN	LAT	SLO
Trained	60	M	79	77	86	56	68	80	72	69	47	M

Notes: M = information not available or too many missing cases (>20%).

When looking at the mean percentage of 'teacher training' topics covered in computer education classes (Table 5.4), it was found that a number of countries (like Austria, Greece, Bulgaria in upper secondary education and India) a majority of the topics included in training are indeed part of actual teaching about computers in the class.

Table 5.4

Mean percent of topics covered in (computer education) lessons, given the computer topics taught in teacher training

	Elementary Schools		Lower Secondary Schools					Upper Secondary Schools				
	JPN	NET	AUT	BUL	GRE	JPN	NET	BUL	IND	JPN	LAT	SLO
Taught	22	M	73	39	64	30	44	60	66	51	72	M

Notes: M = information not available or too many missing cases (>20%).

The implication of the above results is that it seems to be important to carefully consider which topics to include in future training for (computer education) teachers. However, it seems difficult to conclude from the information in this section, what topics need to be included in future in-service training courses. A careful conclusion based on Figure 5.4 might be that more attention should be paid to topics in the category 'computers and society' and 'pedagogical and instructional aspects of computer use'. However, a closer look at the current content of training courses in all countries and some views from experts on the future development of the subject 'computer education' may reveal what is needed in the near future, but that is beyond the scope of this report.

Support for training

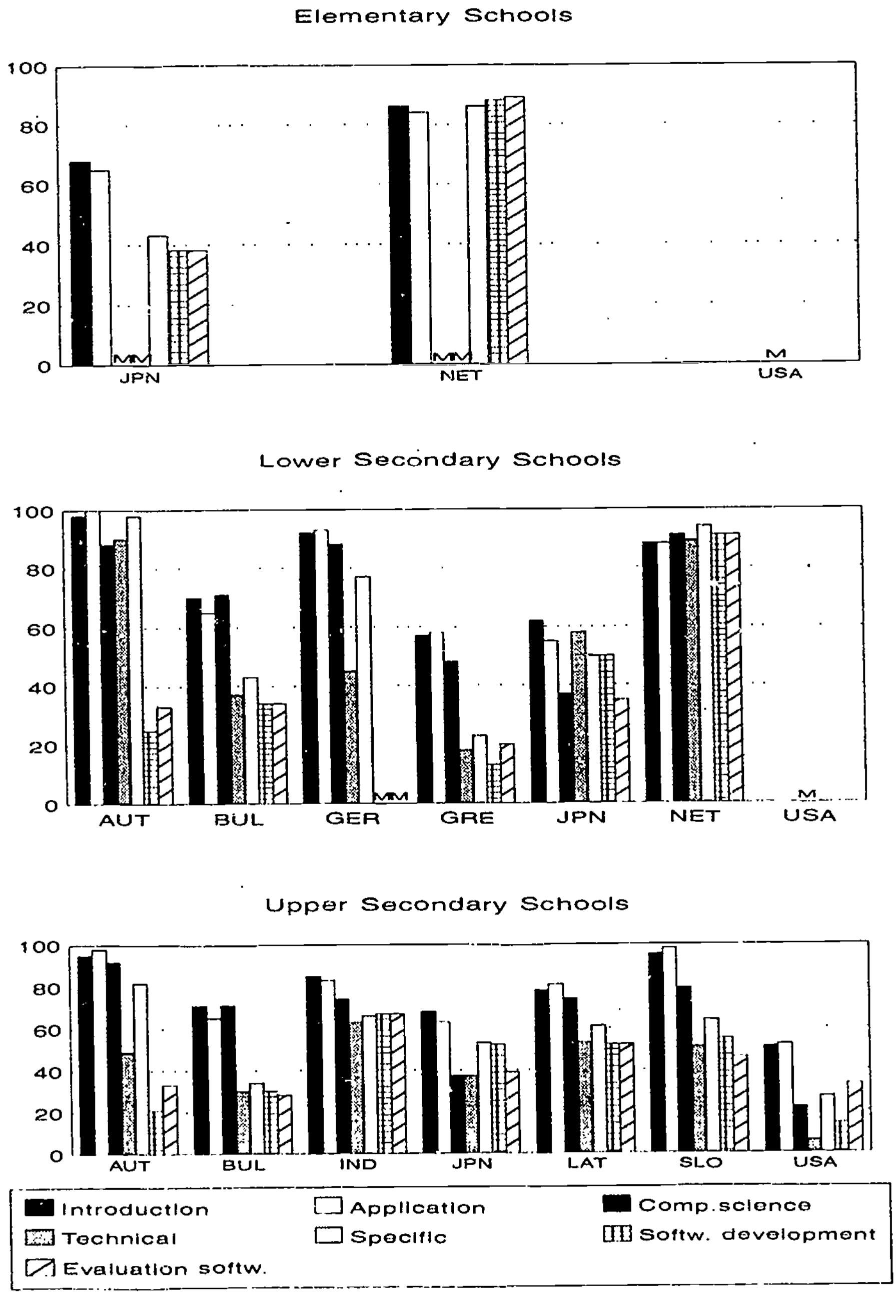
Not only the teacher perspective is important when looking at teacher training. A supportive environment is essential as well. This means that the school should provide training opportunities for the teachers and stimulate participation in the field of using computers in education. Besides, the availability and help of a computer coordinator is known to be an essential support factor for teachers. As this kind of school information is also available from Germany and the USA, these countries are included in the analyses of this section.

Availability of training at school

Computer coordinators are asked what teacher training is available for the teachers regardless of whether this was outside or inside the school.

The results are presented in Figure 5.5, in which reference is made to the following types of training:

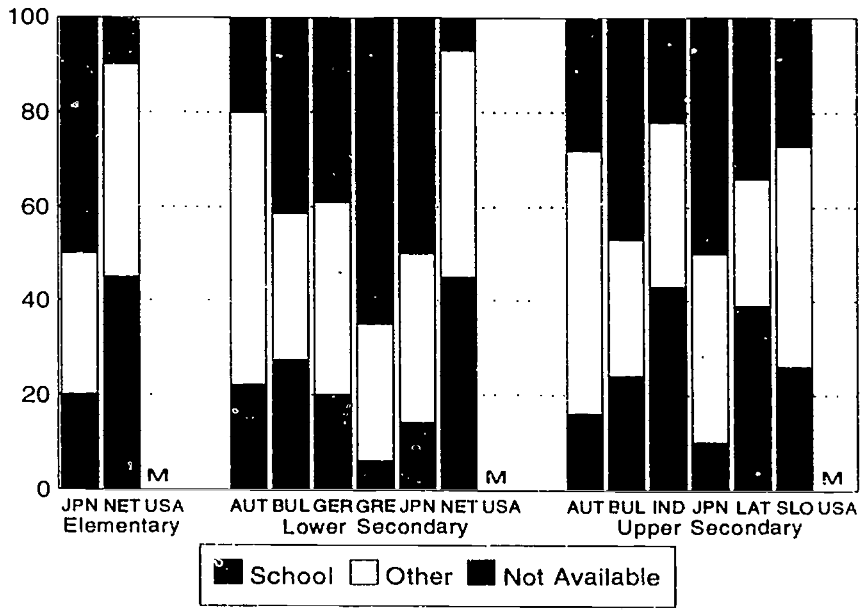
(1) Introduction: general course on how to use computers, hardware and software;
(2) Application: course on using general computer application programs (e.g. word processors, spreadsheets, database);
(3) Comp.science: computer science course, programming (not included in elementary school questionnaire);
(4) Technical: computer science course for technical subjects (not in elementary school);
(5) Specific: course on using computers in specific subjects;
(6) Softw. development: course on educational software development;
(7) Evaluation softw.: course on evaluation of software used in teaching.



Notes: M = information not available or too many missing cases (>20%).

Figure 5.5 Availability of training as indicated by the computer coordinator of computer using schools.

Across countries, the most available types of training are introductory courses and courses in the use of application programs. In Bulgaria and the Netherlands, computer science courses are equally or more important. Only in the Netherlands and in India, learning how to evaluate software and how to develop your own software as a teacher is important as well. This could mean two things. Either the emphasis in these countries is different in the sense that teachers are stimulated to judge and develop software, or it might be an indication that most teachers already have had a kind of introductory course and are now more shifting towards other types of training. On the other hand, when looking at the situation in the USA in upper secondary education (being the country a long way in the process of implementating the computer), it is noteworthy that the availability of training courses is low, regardless of the type of training course. Unfortunately, we do not have any further information from the USA to look into this finding like the training teachers received, or the need for any training.



Notes: M = information not available or too many missing cases (>20%).

Figure 5.6 Agency giving support in teacher training (percentage indicated by the computer coordinator of computer using schools).

Support for training

Looking at the agencies that provide training support might give an indication for the amount of support teachers receive from their environment. First of all, Figure 5.6 provides some insight into the question whether the school or other agencies provided training support.

The figure shows that in many countries not much support is given to training activities. Only in the Netherlands, Austria, India, and to some extent Slovenia, a majority of computer coordinators indicate that support is received. In some countries, the support is equally provided by the school and others (like in the Netherlands), while in other countries other agencies clearly provide more support in teacher training (in Austria, Germany, Japan and Slovenia). For a closer look at the types of agencies (other than the school) which provide support in training, information from the school principals is shown in Table 5.5.

Table 5.5

Percentage principals of computer using schools checking agencies giving support in teacher training

	Elementary Schools			Lower Secondary Schools							Upper Secondary Schools						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
A.	0	14	24	22	59	81	57	9	23	21	42	60	29	15	57	32	19
B.	43	24	67	57	39	31	29	54	16	43	63	36	29	49	24	90	52
C.	36	10	27	25	3	19	4	19	11	29	21	8	3	10	22	33	26
D.	1	2	7	0	1	1	0	0	0	3	0	2	0	3	0	0	5
E.	6	16	19	42	66	13	17	7	47	29	27	74	27	7	49	20	29
F.	31	10	5	6	19	9	19	31	15	11	11	22	7	37	46	20	12
G.	13	M	33	2	1	7	9	21	20	26	2	2	2	14	0	6	40
H.	48	74	41	95	13	23	7	62	80	43	93	21	32	68	M	22	40

Notes: M = = information not available or too many missing cases (>20%).

The explanation of the agencies is:

A. Ministry of Education;
B. Local Educational Authority;
C. Teachers of other schools;
D. Parents;
E. Universities/(teacher training) colleges;
F. Teacher associations/other associations;
G. Business and industry;
H. Support institutions/resource centers

The agencies most important in providing support in teacher training across countries are support institutions/resource centers and local educational authorities.

Ministries of Education seem to play an important role in giving support for teacher training in the more centralized countries (like Bulgaria, Germany, Greece and Latvia). In other countries, like Austria, the Netherlands, and Japan, the support institutions or resource centers play a prevalent role in supporting schools with training. In Greece, the role of these institutes, being pedagogical institutes, is noteworthy low.

Whereas Figure 5.6 showed that other agencies than the school play the most important role in training support in Austria, Germany, Japan and Slovenia, Table 5.5 shows there is no sole external agency across all these four countries that is the most important in providing support. In Austria and Japan support institutions/resource centers are the most important, in Germany the Ministry of Education, while in Slovenia local educational authorities are the external agency providing most support in training.

Role of the computer coordinator

Whereas the above section showed that outside school agencies are important supporters for training, support from inside school is also important. The one person that is most logical for teachers to turn to for support within the school is the computer coordinator. Therefore, we analyzed the availability of coordinators in the schools and the tasks which they perform. Figure 5.7 indicates in what ways computer coordinators are available in the computer using schools.

In all schools in all three populations, a regular teacher is clearly the person taking care of coordinating tasks related to the use of the computer next to his or her teaching task. Only in Germany, a considerable percent of schools indicates having appointed a full-time computer coordinator. A worrying situation (in the light of implementation of computers) appears when nobody coordinates the tasks in a school that is using computers because in that case no person is available in the school to which the teacher can turn to with questions related to computers. This happens in quite a number of schools in Bulgaria, Greece, India, Japan (upper secondary education), Latvia and Slovenia.

Given the fact that in most cases a regular teacher is taking care of the computer coordinating tasks, the question arises what activities can be done in this time.

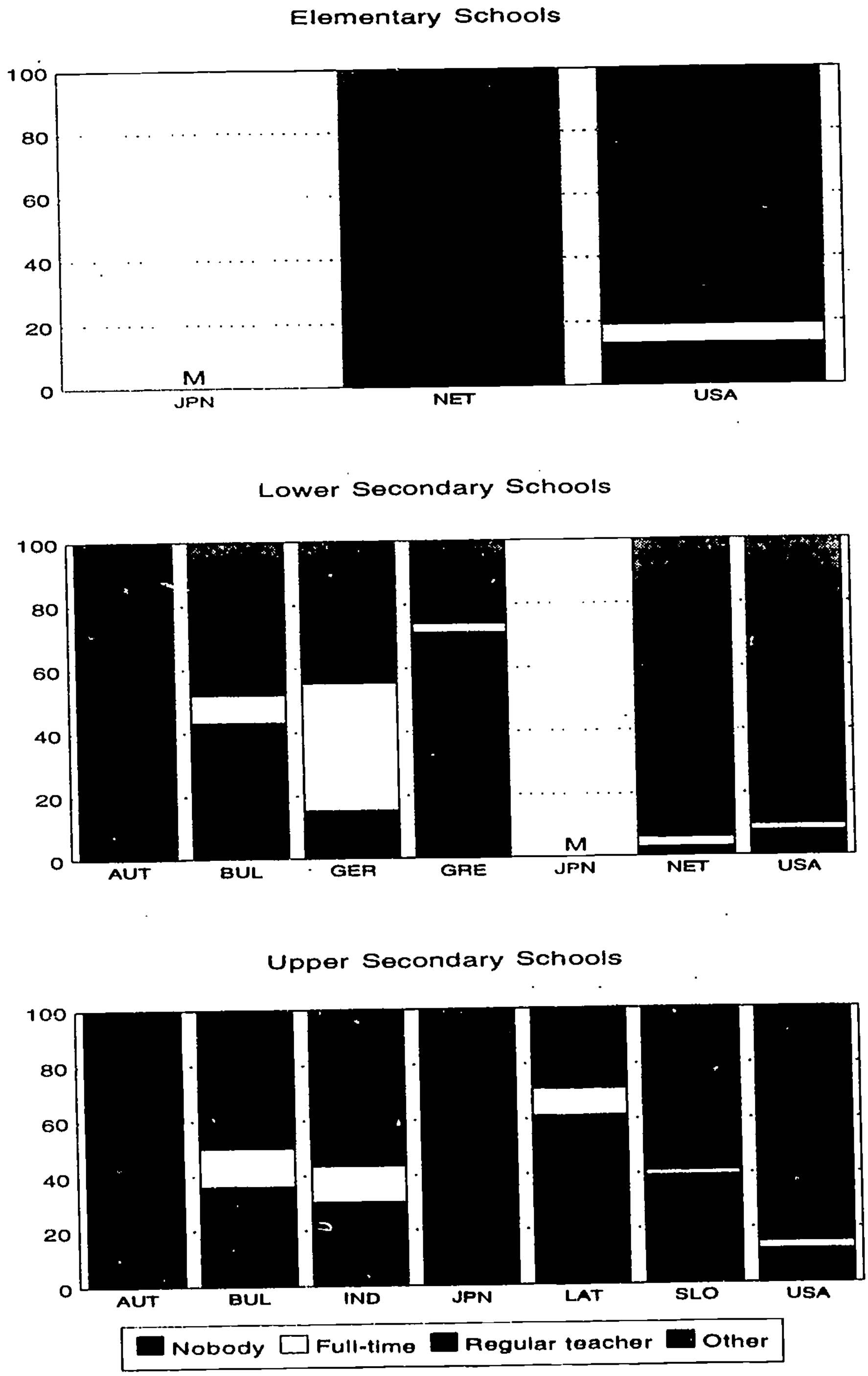


Figure 5.7 Availability and type of computer coordinator in computer using schools.

Table 5.6 contains the percentage time devoted to a number of coordinating tasks per week.

Table 5.6
Mean percentage of time devoted to each coordinating activity per week

	Elementary Schools			Lower Secondary Schools							Upper Secondary Schools						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
A.	M	25	46	39	M	38	M	24	37	55	46	50	58	28	M	M	55
B.	M	33	22	23	M	21	M	24	26	17	18	25	15	28	M	M	17
C.	M	24	16	22	M	26	M	29	16	14	20	18	11	21	M	M	13
D.	M	11	12	13	M	12	M	15	15	12	12	9	9	16	M	M	13
E.	M	8	3	3	M	1	M	7	6	2	14	1	7	7	M	M	1

Notes: M = information not available or too many missing cases (>20%).
The explanation of the activities is:

A. Helping students ('Teaching students about computers' or 'Supervising students when using software');

B. Helping teachers ('Learning teachers to use computers', 'Selecting instructional materials', 'Writing instructional software' and 'Writing lesson plans');

C. Developing own skills;

D. Equipment and program maintenance;

E. Other computer coordinating activities.

A lot of the time regular teachers spent on coordinating computer use in school is spent on helping the students. This findings seems to suggest that in most countries the computer coordinator is the one who is also teaching computer education or assisting in the school with this work. The second most important coordinating task in most countries is helping the teachers. Whereas the coordinator is an important source of information for a teacher, the data seem to indicate that there is not very much time for assistance of teachers due to the fact that helping students takes the majority of time of the coordinator.

Developing the skills of the computer coordinator is important in countries like Austria, Japan, Germany and the Netherlands (elementary education). This means that the coordinators in these countries seem to have the feeling that they do not know enough about computers.

Conclusion

In this chapter a number of factors that are possibly related to the training of (computer education) teachers were analyzed. It is important to stress the fact that only the perspective of the computer education teachers in secondary education is covered in this chapter. Particularly for countries in which learning about computers only or mainly takes place within existing subjects, (like Germany and Austria) it is important to study the perspective of this group of teachers as well. This will be done in future publications on the Comped study.

It was found in this chapter that (computer education) teachers score high on self-rating scales dealing with knowledge about and skills in using computers, but this does not mean that further training for this group of teachers is not necessary anymore. Teachers indicate that continuing education is needed to keep up with this vast developing technology. The importance of training is also shown from the relation between what is taught in the training courses and the topics covered in the class when teaching about computers. A careful consideration of the type of training that is needed in the future is necessary and the information from this chapter seems to point to some possible categories of topics that are not yet covered very much in training courses. These categories are 'computers and society' and 'pedagogical/instructional aspects of computer use'. However, information from other sources (experts or policy instruments on developments in the field of computer education) is needed to come to definite conclusions as to what future teacher training should look like.

A look at the school environment in which the teachers have to work shows that there is quite a good deal of training available for teachers and that schools as well as others (such as local educational authorities and support institutions/resource centers) are supportive to training activities. Furthermore, in most schools a regular teacher is available as 'computer coordinator'. This coordinator spends most of his/her coordinating time on helping the students, but there is some time for helping the teachers as well. Given this information, a first conclusion might be that schools can be called supportive to the introduction of the computer. More analyses have to be done before definite conclusions can be drawn.

6

Gender and Computers: Another Area of Inequity in Education?

Although equal developmental opportunities for girls and boys seem to be a self-evident element of educational policy in most countries, it is found in a number of research projects that the daily practice concerning the use of computers in education does not reflect this principle of equity (Voogt, 1987; Durndell, Macleod and Siann, 1987,; Damarin, 1989, Sutton, 1991). Differences deal with access to computers and achievement in the area of computer use. In addition, differences between female and male students in attitudes towards computers are also reported.

Using the framework of Sutton (1991), Janssen Reinen and Plomp (in press) mention three 'stages' in which the difference between female and male students with regard to computer use evolves.

1. *Input variables: access and socialization.*
   Differences in access to computers (both in school and outside of school) and different socialization experiences contribute to the fact that computers are less used by female students (Siann, Macload, Glissov & Durndell, 1990).
2. *Process variables: female role models, organization and type of computer use.*
   The number of female teachers working with the computer in the school and the type of role model they furnish is especially important for female students (Yeloushan, 1989). Besides, promoting 'positive discrimination', that is creating situations in which girls are the only ones working with computers, seems to be important. One of the organizational problems for girls seems to be the timetabling of the different subjects (Gardner, McEwen & Curry, 1986), which quite often is based on the assumption that students choose combinations of computer courses and science courses rather than combinations of computer courses and for instance social sciences. Concerning the type of computer use, it is found that gender differences mainly appear in programming courses and voluntary activities (Moore, 1986).

This chapter was written by Ingeborg Janssen Reinen and Tjeerd Plomp.

3. *Output variables: student ability and attitudes.*
   Durndell et al. (1987) found that males knew significantly more about computers than females do. One of the most important reasons for this is the difference in access to computers and the possibility to practice with them. Besides, female students often have a less positive attitude towards computers (Martin, 1991, Siann et al., 1990).

In this chapter, the above framework to map out gender differences is used to study the Comped data. This means that first we need to look at the output variables: are gender differences found in the Comped study with regard to knowledge about computers and attitudes towards computers?

Factors mentioned above as input or process variables are studied here as possible sources of gender differences in knowledge and attitudes.

Gender and computers: is there a difference between girls and boys (a look at the output variables)?

As briefly described in the introduction of this chapter, the first question that arises when looking at the Comped data from a gender perspective is whether a difference between female and male students is found in their knowledge about computers (or their achievement in the field of computer use), their attitudes towards computers and the problems they experience when using this new technology.

Difference in scores on the FIT-test

As described in Chapter 4, all students participating in stage 2 of the Comped project were given a Functional Information Technology Test (FITT), in order to test student knowledge in the domain of functional computer knowledge. In that chapter more details are given about the development, reliability and validity of the FITT.

Table 6.1 shows the distribution of females and males in the samples of students in the target grades of the study. This distribution is rather equal for all countries and all populations. Only in India in upper secondary education is the percentage female students considerably lower than the percentage male students, while the situation is reversed in Bulgaria in upper secondary education with a relatively high percentage of female students.

Table 6.1

Total number of tested students (#) in the sample of the target grade and percentage girls (%g)*

	Elementary Schools		Lower Secondary Schools		Upper Secondary Schools	
	#	%g	#	%g	#	%g
AUT	-	-	5,397	49	2,797	48
BUL	-	-	2,086	55	2,067	65
GER	-	-	1,463	49	-	-
GRE	-	-	3,635	52	-	-
IND	-	-	-	-	12,945	32
JPN	4,939	48	5,481	48	4,572	43
LAT	-	-	-	-	2,228	54
NET	3,615	52	4,905	50	-	-
SLO	-	-	-	-	3,431	58
USA	4,316	51	3,746	51	2,999	53

Notes: - = data not collected, * = for elementary and lower secondary schools one target grade was defined and only students from this grade are included in this chapter. For upper secondary education, the target grades differ among and within countries. See for more details Appendix 2 with the sample information.

When looking at the FITT-score broken down by gender (Figure 6.1), it is found that male students score higher than female students on the FITT in all countries. However, a look at the 95% confidence interval around the mean shows that in the USA in all populations, in Bulgaria in lower and upper secondary education and in India in upper secondary education differences between the two gender groups are not significant.

Large differences between females and males in the domain of functional computer knowledge are found in Germany, Austria, Japan (lower and upper secondary education), Slovenia and Latvia.

Although the trend of a gender difference in FITT-score in all countries is clear, the picture shown in Figure 6.1 might be somewhat overstating the difference. Table 6.2 shows the difference between the average percent correct score of the males minus the average percent correct scores of the females

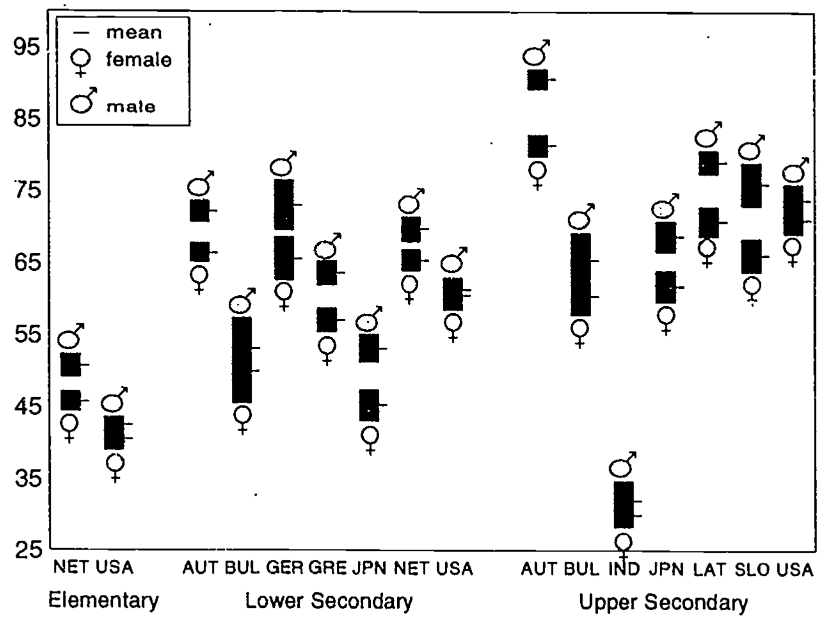


Figure 6.1 Mean FITT-score and 95% confidence interval for female and male students.

The difference in average percent correct score is, when brought back to a difference in number of correct answered items on the test, in elementary school and in some countries in lower and upper secondary school not more than one item. Although the differences are larger in secondary education, the differences between the average number of correctly answered items in the test is never larger than 3 items in a test of 27 items. Table 6.2 also shows that, in general, the gender difference is the largest in upper secondary education.

In order to find out in more detail whether the differences between female and male students can be attributed to certain areas of computer use, we used the content grid with which the FIT-test was developed. A set of knowledge domains related to computer use were defined with the help of experts in the field, resulting in a content grid of three parts:

A. The computer as part of Information Technology: what are computers and how do they operate?
B. Using computers: what are your computer-handling skills?
C. Applications: what can you do with information Technology?

Table 6.2

Average percent correct scores of male students on the FITT minus the average percent correct scores of female students and translation of this difference to number of correct answers on the test.

	Difference Male-Female % correct score	Number of correct test items
Elementary Schools		
NET	5.03 *	0.9
USA	1.95	0.7
Lower Secondary Schools		
AUT	5.72 *	1.5
BUL	3.14	0.9
GER	7.49 *	2.0
GRE	5.54 *	1.5
JPN	7.92 *	2.1
NET	4.35 *	1.2
USA	0.86	0.2
Upper Secondary Schools		
AUT	9.25 *	2.5
BUL	4.96	1.3
IND	2.01	0.5
JPN	6.93 *	1.9
LAT	8.26 *	2.2
SLO	9.9 *	2.7
USA	2.77	0.8

Notes: * = the difference in FITT score between female and male students is significant (see Figure 6.1).

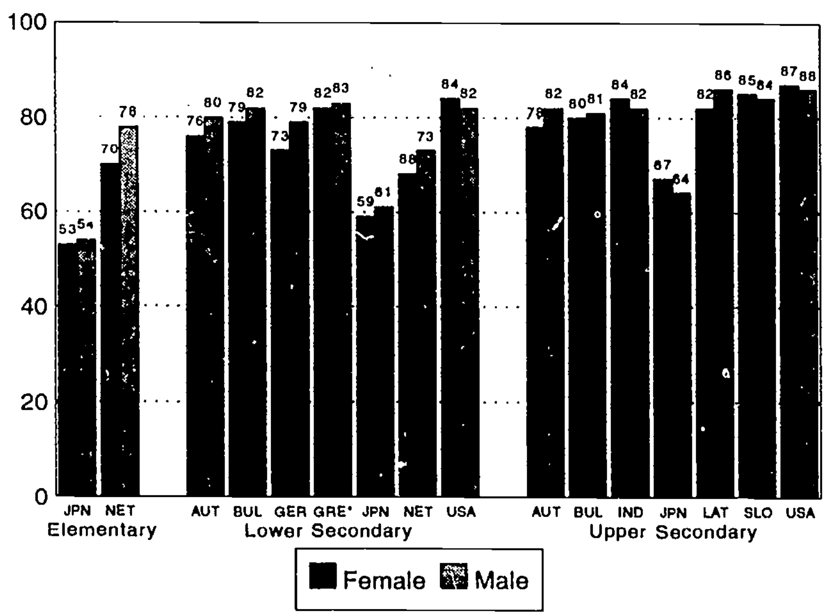
Each part of the content grid consists of subdomains. A complete description of the content grid is included in Appendix 11.

In order to find out whether a gender difference can be found in one or more of these general knowledge domains, three domain-scales were defined with the items of the FIT-test that were predefined as belonging to each of the above parts of the test grid. This means that for the 27-items FIT-test 13 items belong to part 1 of the grid, 9 items belong to part 2 and 5 items to part 3 of the content grid. Appendix 12 shows for each item of the FIT-test to which knowledge domain it belongs. Within elementary education, the FITT consisted of 17 items, 12 of which belonging to the first part of the content grid and 5 belonging the second part.

The reliabilities of the scales show that trying to find domain-scales in the FITT does not work out when these scales are formed with the use of the original content grid of the test. The reliabilities of the three scales are low and as such, it does not make sense to study gender differences on these domain-scales. Further analyses on possible other scales of the FIT-test will be done in a later report on the study.

Difference in attitudes/opinion

In Chapter 4 the attitude questionnaire, consisting of the three scales 'relevance', 'enjoyment' and 'parental support', is explained and general results for the total group of students are discussed. Reliabilities for the first two scales were found to be satisfactory while the scale on parental support needs to be treated with caution. In this section we look at the relevance and enjoyment scales from a gender perspective. Later on in this chapter the role of the parents will be dealt with.



Notes: * = only students in computer using schools.

Figure 6.2 Percentage (strongly) agree on attitude scale 'relevance' for both female and males students.

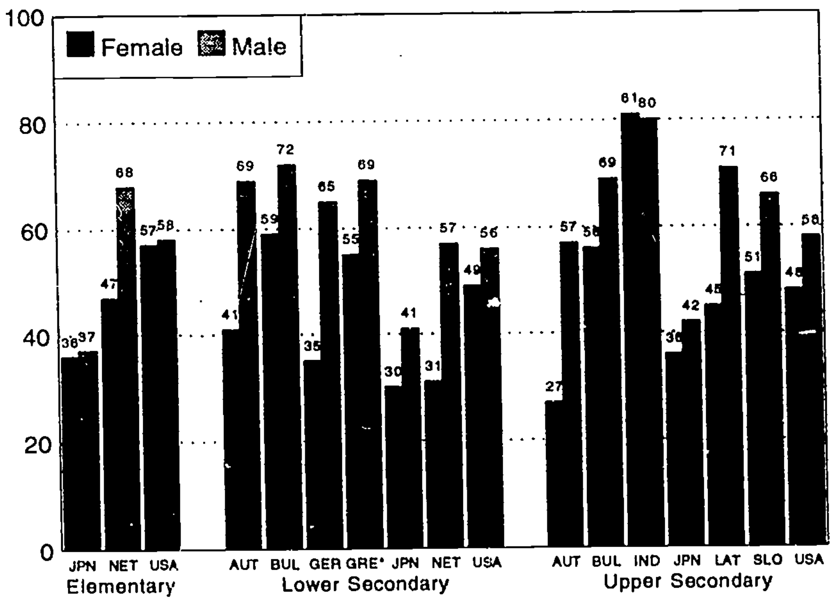
Relevance

When looking at the results on the relevance scale (Figure 6.2) for both females and males, it is found that in elementary and in most countries in lower secondary education males are more positive about the relevance of computers, although differences are only significant in Austria, the Netherlands, Latvia and Japan (upper secondary education).

Only in Japan in upper secondary education, female students are clearly more positive about the relevance of computer use than males.

Enjoyment

When looking at the gender perspective on the enjoyment scale, some striking differences appear. As can be seen in Figure 6.3 in all countries (except Japan and the USA in elementary education, and India in upper secondary education), female students tend to enjoy computer use significantly much less than males do. Especially in Austria, the Netherlands, Germany and Latvia these differences are striking.



Notes: * = only students in computer using schools.

Figure 6.3 Percentage (strongly) agree on attitude scale 'enjoyment' for both female and males students.

In general, the differences between female and male students are larger for the enjoyment scale as compared to the relevance scale. This means that both girls and boys at least see that the computer can have its advantages but females do not like computers as much as males do.

A question is whether the attitude of students is related to their performance in the FIT-test. The correlations between the test-score and the attitude scales 'relevance', respectively 'enjoyment', are found to be significant ($p < 0.05$), but not meaningful for any of the countries in each of the three populations. The correlation between the FITT-score and the enjoyment scale is higher in each country than the correlation with the relevance scale.

Gender specific opinions

Beside the question on attitudes, a question was given to the students with respect to their opinion on gender issues and computer use. The question is stated in Table 6.3.

The opinion of students for each of these gender issues is shown in Table 6.4.

Table 6.3

Question concerning gender related options

The following items are related to the use of computers by male or female. Give your opinion about each question.

Question	Opinion		
Who, do you think, is more likely to play computer games?	boys	equally boys and girls	girls
Who, do you think, is more likely to enjoy using computers for practical jobs?	boys	equally boys and girls	girls
Who, do you think, is more likely to get a job doing computer programming?	boys	equally boys and girls	girls
Who, do you think, knows more about computers?	boys	equally boys and girls	girls

Table 6.4
Mean percent of female (f) and male (m) students in each country that answered each option of the gender question

	Play Games**			Practical Job**			Comp. Program.**			Knowledge**		
	Boys	Equal	Girls	Boys	Equal	Girls	Boys	Equal	Girls	Boys	Equal	Girls
Elem.												
JPN-f	72	26	2	23	49	28	42	31	27	49	38	13
JPN-m	80	18	2	31	50	19	47	33	20	60	31	8
NET-f	33	65	1	26	66	8	34	61	5	28	69	3
NET-m	48	52	0	24	71	6	37	59	4	40	60	1
USA-f	16	76	8	11	52	37	M	M	M	12	64	24
USA-m	36	60	4	23	53	23	M	M	M	38	55	7
Low.Sec.												
AUT-f	40	59	1	31	60	9	62	34	4	38	60	2
AUT-m	53	45	1	37	55	7	61	34	5	49	50	2
BUL-f	35	62	3	18	69	14	22	60	18	33	60	7
BUL-m	62	36	2	29	60	11	29	53	18	44	50	6
GER-f	60	40	0	34	55	11	36	56	8	54	46	1
GER-m	72	28	1	38	55	7	40	49	11	58	42	1
GRE*-f	36	62	2	21	63	16	21	69	10	32	60	8
GRE*-m	70	29	1	35	56	8	36	56	8	58	38	3
JPN-f	80	19	1	30	51	19	28	40	31	63	31	5
JPN-m	85	14	1	37	46	17	34	38	28	58	35	8
NET-f	48	51	1	20	71	9	33	63	3	31	67	2
NET-m	56	43	1	16	73	10	33	63	4	35	64	1
USA-f	41	56	2	9	58	33	16	57	27	12	73	15
USA-m	57	40	3	15	63	22	23	56	21	28	67	5
Upp.Sec.												
AUT-f	56	44	0	26	69	5	73	26	0	45	54	1
AUT-m	60	39	0	35	63	3	67	33	0	58	42	0
BUL-f	46	51	3	20	69	10	29	57	14	41	54	5
BUL-m	65	33	2	39	55	6	36	50	15	56	41	3
IND-f	17	74	9	15	62	23	15	61	24	21	68	11
IND-m	30	65	4	28	62	10	28	55	16	35	59	6
JPN-f	86	13	1	32	48	20	31	39	29	60	35	4
JPN-m	87	12	1	38	47	15	40	38	22	59	38	4
LAT-f	57	42	2	48	48	4	64	33	3	76	21	3
LAT-m	71	27	1	59	37	4	68	28	4	78	20	2
SLO-f	60	39	1	53	42	4	33	62	5	45	50	4
SLO-m	74	25	1	60	38	2	31	60	10	56	43	1
USA-f	68	31	1	9	66	24	21	59	19	15	77	8
USA-m	76	23	1	15	67	18	29	53	18	36	60	4

Notes: M = information not available or too many missing cases (>20%), * = only students in computer using schools, ** = see Table 6.3 for full text.

A majority of students in almost all countries think that both gender groups enjoy using computers for practical jobs equally. This is not completely in line with the earlier findings on the agreement with the enjoyment scale in the attitude questionnaire where female considerable less agree with enjoyment attitude statements than male students do. This findings might be explained with the so-called 'we can, but I can't' paradox (Collis, 1985). When explicitly asked about a gender difference (as in the question stated in Table 6.3), females might feel the need to stress equality between both gender groups in general (we can), but when asked about their own individual attitudes, they personally feel less enjoyment in using computers (I can't).

Table 6.5
Question concerning problems with computer use

Listed below are a number of problems that students have reported in using computers in schools. For each problem, indicated how often this has been a problem for you in using a computer at school during this school year.
Please, circle for each problem one answer.

Problem in using computers	How often			
Computers are not available when I want to use them	no, never	sometimes	often	very often
Programs are difficult to understand and/or use	no, never	sometimes	often	very often
Programs are not to my interest	no, never	sometimes	often	very often
Help is not available when I need it	no, never	sometimes	often	very often
Other problems (*please specify*) ____________		sometimes	often	very often

A similar comparison can be made between the question on who is likely to know more about computers, and the results of the FIT-test. In Germany, Japan, India and the USA it can be said that both a majority of female and male students best predict the knowledge of girls and boys when answering the question who is more likely to know more about computers. In Germany and Japan (in all populations) both female and males think that boys know more about computers and this is confirmed with the score on the FIT-test. Similarly, both females and males in India and the USA (in all populations) think that boys and girls have an equal amount of knowledge about computers. Again, this is confirmed by the FITT.

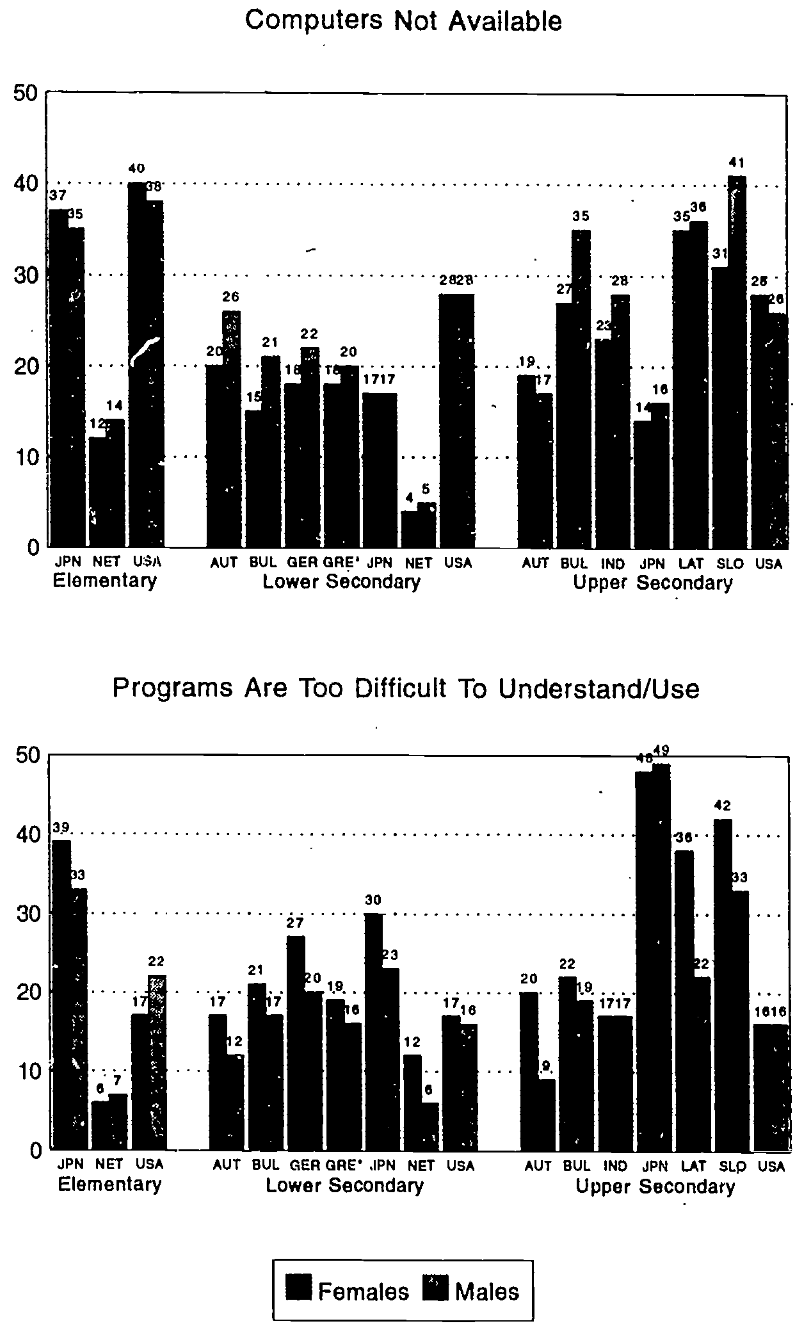
In most other countries, the comparison between the gender related opinion on knowledge and the FITT does not show such similarities.

Differences in problems experienced

A third indication of the state of gender differences (next to FITT-score and attitudes/opinions) can be derived from an inspection of the problems students indicate they experience in computer use. The question given to them is stated in Table 6.5.

Analyses showed that no general scale on 'problems experienced' could be formed. Therefore, the problem items will be dealt with separately. The results on the problem items from a gender perspective are shown in Figure 6.4.

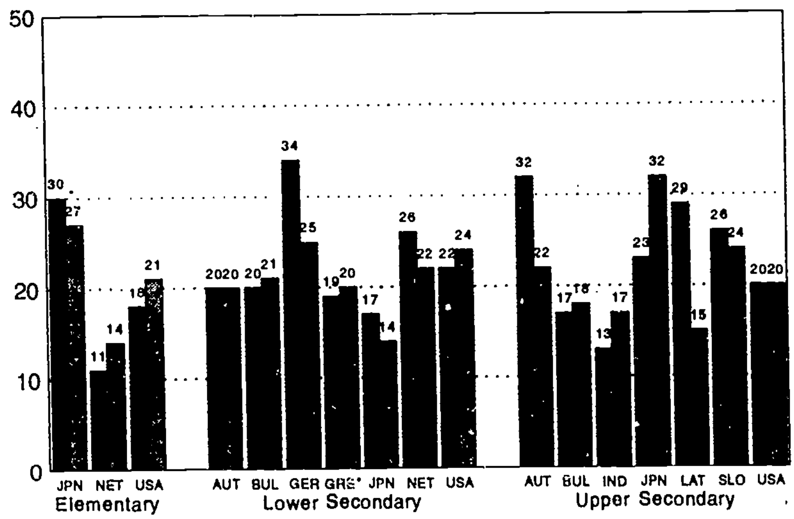
In two countries (Austria in lower secondary education and Slovenia in upper secondary education), males would like to have more computers at their disposal, because they, significantly more often than females, indicate that lack of available computers is a problem. Consistently over almost all countries in lower and upper secondary education, female students report having more difficulty in understanding or using programs. However, the difference is only significant for the USA in elementary education, for Austria and the Netherlands in lower secondary education and for Austria and Latvia in upper secondary education. Gender differences on both problems related to software (programs not to the students' interest or too difficult) are significant for Austria and Latvia in upper secondary education, where female students experience both software problems as more serious than males.



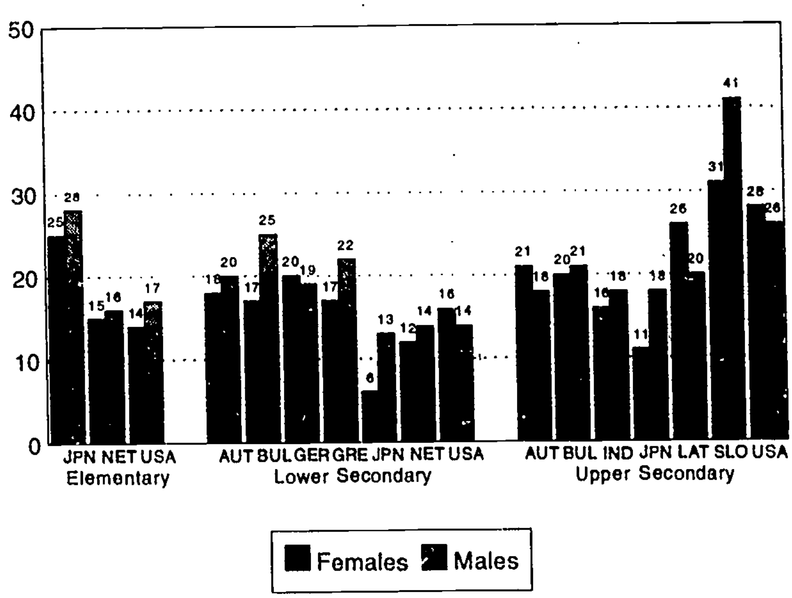
Notes: * = only students in computer using schools.

Figure 6.4 Situations perceived (very) often a problem for female and male students (percentage) (continued).

Programs Are Not To My Interest



Help Is Not Available When Needed



Notes: * = only students in computer using schools.

Figure 6.4 (continued) Situations perceived (very) often a problem for female and male students (percentage).

Overall, when looking at the current situation in educational computer use from the perspective of gender differences, the trends seem to point in the direction of a less positive situation for female students. They score lower on the FIT-test and their attitudes are less favorable than those of the male students, especially when looking at 'enjoyment to work with computers'. At best, females think that the computer is something for them as well as for males in general, but personally they do not feel as attracted to computers as male students do. Finally, female students in some countries seem to have more problems with the software (being too difficult or not to their interest). Overall, the most 'gender equal' picture on computer use by students is shown by Bulgaria and the USA, while Austria, Germany and Latvia seem to be the countries with the largest gender differences in knowledge about, attitudes towards and problems with computers.

Possible causes of gender differences

The first question that arises after having described the current situation of gender differences is how these differences between female and male students could arise. In the literature, several factors are mentioned that possibly may influence the difference between female and male students in their knowledge about and attitudes towards computers. As indicated in the introduction to this chapter, the factors that have an influence on the gender differences can be grouped as being 'input variables' or 'process variables', the first one deals with factors that mainly lay 'outside' the school environment and the last one deals with the daily educational practice. Both groups of factors will be discussed in this section with the question whether the Comped data might give indications of what the influence of certain factors is on the output of students in the field of computer use.

Input variables: socialization and access

Socialization experience

Earlier research showed that differences between female and male students in the area of computers can be explained, at least in part, by the home situation of the students. As Martin (1991) states, differences in attitudes towards computers can be explained by the differential socialization of males and females which results in stereotypical sex-specific roles. Socialization differences between females and males can, amongst others, be influenced by the stimulation of parents or through imitation of 'significant others'. When looking at process variables explaining possible gender differences, one of the 'significant others' is the teacher and his or her role in using the computer at school. The importance of 'socialization' can be illustrated by referring to Yeloushan (1989), who found that a major social barrier for females is the attitudes of parents and teachers who believe that computers are learning tools predominantly for males.

The stimulation of parents in the field of computer use is studied by using the attitude list mentioned earlier in this chapter. Two items were included dealing with the role of parents in the area of computers and as mentioned in Chapter 4, they form a so called 'parental support' scale. In that chapter it was also indicated that the reliability of this scale is much lower than the ones for the other two attitude scales. Therefore, the two parental support items will be dealt here as separate items and not as a scale. The items for which the students needed to indicate whether they agreed with it were 'my parents encourage me to work with computers' and 'my parents want me to be good at working with computers'.

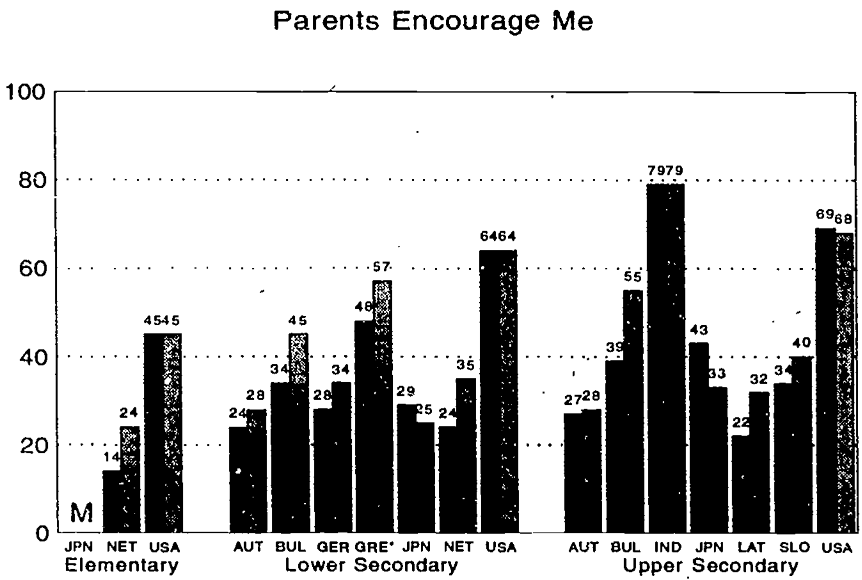
The amount of agreement with the two items for the group of female and male students separately, is indicated in Figure 6.5.

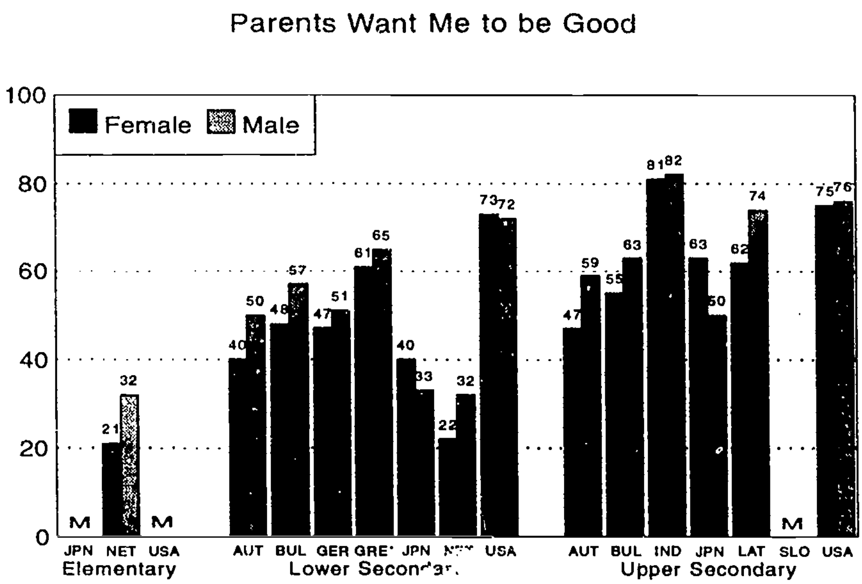
Figure 6.5 shows that in some countries the difference between female and male students on their agreement with both parental support items is noteworthy (like Bulgaria in upper secondary education, the Netherlands, Greece and Latvia), all indicating that parental support is given significantly more to male students. In Japan, girls agree more with the parental support items.

In the USA and India, no large gender difference is found and in Austria only a clear difference appears when looking at the second item (parents want me to be good).

This result might be an indication of the difference in socialization between girls and boys. However, some caution is necessary in interpreting the data because the way students answered the opinion items might be influenced by socially desirability and, as such, the results might reflect the socialization role that is expected from students and not so much the objective amount of (or lack of) parental support.

As a first indication of the influence of parental support on the students, the correlation between the two attitude items and the FITT-score was studied. The correlation between the items and the FITT-score is very low in all countries.



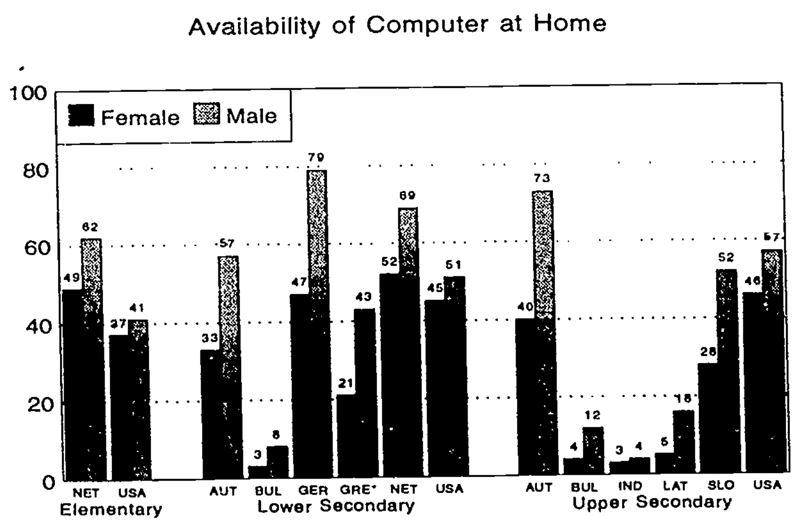


Notes: M = information not available or too many missing cases (>20%), * = only students in computer using schools.

Figure 6.5 Percentage (strongly) agree on the parental support attitude items for both female and male students.

Access to computers

Beside the role of the parents, access to computers might be a factor that determines the knowledge and skills of male and female students. When looking at access in terms of the *availability of computers* at home (see Figure 6.6), it is clear that males are in a more positive situation than female students are. This difference is significant for all countries but the USA in elementary and lower secondary education and India in upper secondary education.



Notes: * = only students in computer using schools.

Figure 6.6 Percent female and male students indicating having a computer available at home.

This finding is contradictory to expectation. The initial expectation was that purchasing of computers was determined by the enthusiasm of the father in the family and as such no gender difference was expected for the availability of computers at home for female and male students.

When looking at access to computers in terms of the *use of computers* at school and/or outside school, four different groups of students can be distinguished (see Chapter 2), namely no use at all, only computer use outside school, only computer use at school and computer use both outside and inside school. Figure 6.7 shows the percentage of male and female students belonging to each of the four groups.

The female group that has no access to computers is larger than the male group in Austria and Japan in lower and upper secondary school, Bulgaria in lower secondary and Latvia in upper secondary education. Especially in Austria, Bulgaria, Germany, Greece and Slovenia the inspection of the gender groups that use the computer only at school or in and outside school, shows that female students are predominantly represented in the group that has access to computers only at school.

However, the above figure needs to be treated with some caution. Access is referred to as dealing with the use of computers in and outside school but the inside school use refers to computer use during the year of data collection (1992) only. It is possible that the students have worked with computers at school before the year in which data collection occurred. Also, it is shown that there are students in the group 'not having access to computers' (in terms of not using a computer) who indicated having a computer available at home. Maybe they do not use this home computer.

A first step is taken to find out what the influence of access to computers (in terms of using the computer) is on the outcomes at student level.

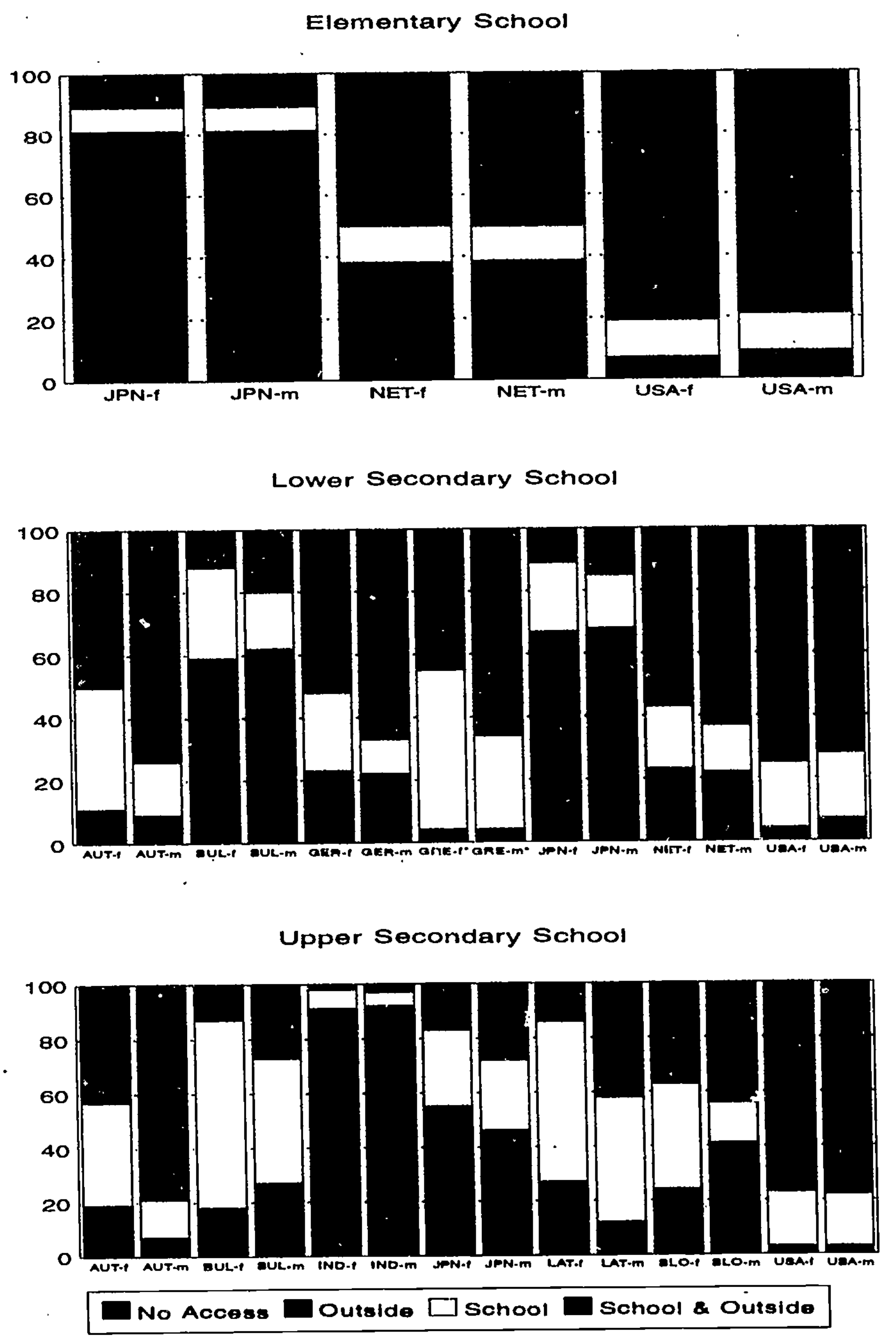
In all countries, except the Netherlands, the FITT-score of female students using the computer in school is higher than the score for the females only using the computer outside school. This findings seems to be an indication that in these countries in school use of the computer is important for this gender group.

For males, the situation is more diverse. In both lower and upper secondary education, there are two countries in which the boys' score on the FIT-test is higher when they use the computer only outside school (Japan and the Netherlands in lower secondary education and Japan and Slovenia in upper secondary education).

An equal number of countries is found in which the boys' score is higher for the group that uses the computer only at school (Austria and USA in lower secondary education and India and USA in upper secondary education).

The above results indicate that in many countries, the school is an important environment for female students to work with computers in the sense that it compensates for the lack of opportunity to work with computers outside school. From an equity perspective, this is an important argument for stimulation policies in the area.

The fact that there are differences in access to computers, might also be an indication of the difference in attitudes towards computers as mentioned earlier in this chapter.



Notes: * = only students in computer using schools.

Figure 6.7 Percent females (f) and males (m) belonging to each of the four user groups.

When looking at the results on the relevance scale for both males and female of the four types of computer using groups (no use, only outside, only at school or both outside and inside school), the noteworthy difference appears when comparing the group of outside school and inside school computer using (fe)males on their agreement on the relevance scale. In most countries, across all three populations, females agree more on the relevance of computer use when they use the computer at school. If the expectation is that perceiving the relevance of working with computers is a prerequisite for optimal computer use, again the conclusion is that the school environment and the possibilities of using computers in this situation is especially important for female students.

Concerning the enjoyment-scale, we found that girls score higher on the enjoyment scale when using the computer at school in the USA (lower secondary education) and Austria (upper secondary education). The most striking observation is the decreasing enjoyment of boys when comparing the group of outside school users and inside school users. In Germany, Japan and the Netherlands in lower secondary education and in Japan in upper secondary education, the scores on the enjoyment scale are considerably lower for the group of males who only use the computer at school. The difference in percentage agreement range from 10% (Germany and Japan in lower secondary education) to 23% in Japan in upper secondary education. Whereas the conclusion in Chapter 4 was that the group of only outside school computer users is more motivated to use computers, the findings presented above seem to indicate that this particularly holds for male students.

The findings in this section concerning the 'input' variables in the gender debate, seem to indicate that the 'input' for computer use by females is different than for males: indications are found that socialization experiences and access to computers lead, at least in some countries, to the creation and/or preservation of gender differences. As we found that gender equity is the least problem in the USA, in this section is was found that parental support is high (and equally given to both sexes) in this country, and female and male students are the most 'equal' in terms of using the computer both inside and outside the school. Unfortunately, the same conclusion cannot be drawn for Bulgaria, the other country which we found to be rather 'gender-equal'. Gender equity being a major problem in Austria, Germany and Latvia, we found in this section that a large difference between the gender groups in access to computers, both in terms of availability and use, might be one of the factors that play a role in explaining this difference.

Process variables

Teacher role model

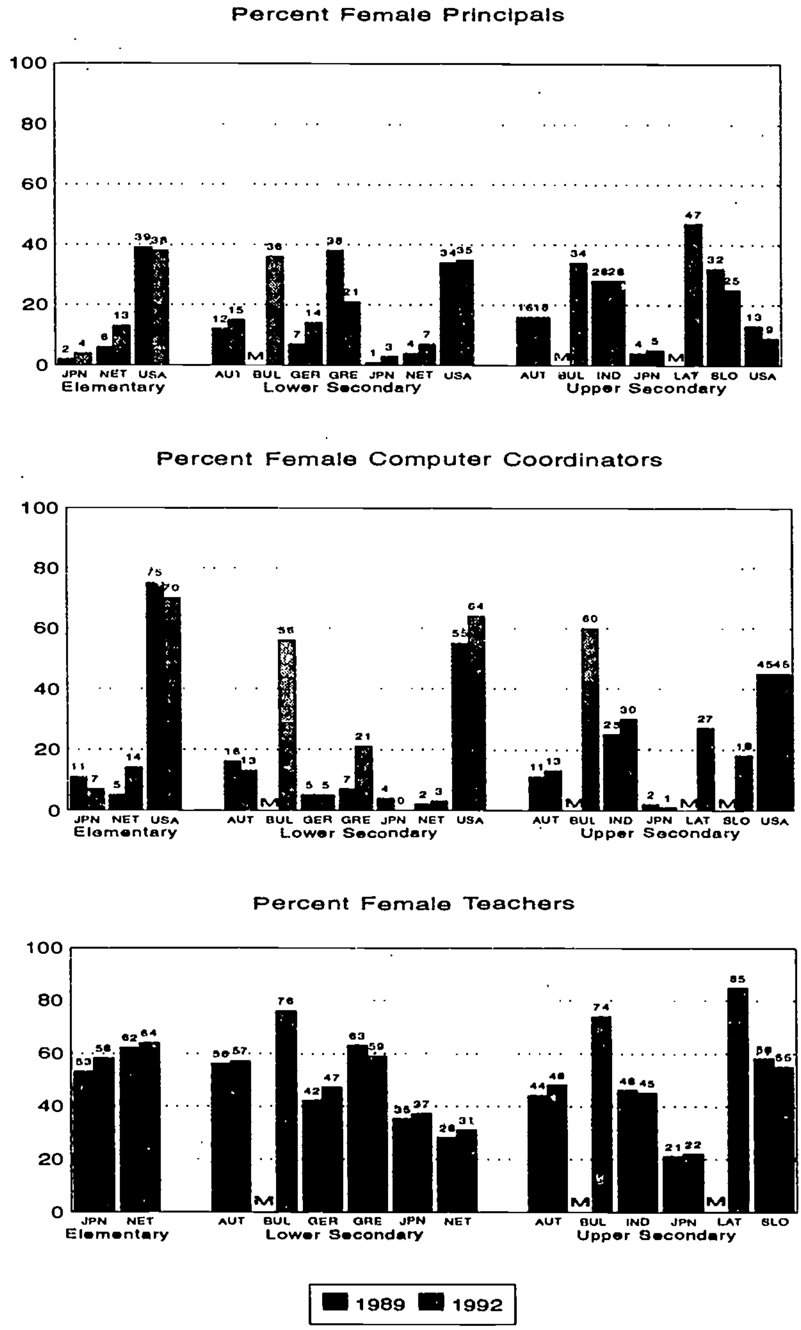
As the opportunity to work with computers at school seems to be important for female students, it is important to investigate to what extent the situation of the school environment is related to gender differences. Factors mentioned in the literature concerning influences in school deal, among other things, with the role of the teacher, the type of activities carried out with the computer, and the policy of the school with regard to the gender issue.

It is generally accepted that it is important that girls get examples of women working with the computer, serving as a role model for them. This can be done by asking professionals to come to the school for a talk about their professional work with the computer, but role models can be provided by internal people as well. When looking at the number of female staff positions (principals, computer coordinators and teachers, see Figure 6.8) in the computer using schools, it is found that in most countries (except Bulgaria, Latvia and the USA) a majority of the staff positions is occupied by males.

The finding of a more positive situation in female staff positions in Bulgaria and the USA might be one of the factors contributing to the earlier conclusion of these countries being the most 'gender equal'.

Data from the first stage of the project are included and as far as comparisons are possible, it can be seen that there have not been many changes in comparison with 1989. Although in some countries the situation of female computer coordinators and teachers positively changed in the period between 1989 and 1992, the overall picture still shows that computer use is a male dominated activity. The large decrease in female principals in Greece was discussed with the national center of the study but no explanation was found yet for this finding.

As a criterion for further analyses on the type of role model teachers provide, each gender group in the sample of the teachers should at least consist of 30 respondents. However, only Austria in lower secondary education and India in upper secondary education satisfy this rule. Because of this small number of countries, no further analyses are done on the type of role model female or male teachers provide their students with. In order to get an impression about the type of role model of teachers, we summarize the findings of Comped data from 1989.



Notes: M = information not available or too many missing cases (>20%).

Figure 6.8 Percent female principals, computer coordinators and teachers in computer using schools.

The analysis of the data in 1989 showed that female teachers give themselves a lower self-rating with regard to computer knowledge and skills as compared to their male colleagues. The largest differences were observed regarding the self-ratings about programming. Concerning the attitude of teachers towards computers, it was found that male teachers have significantly greater self-confidence regarding computers. These findings might be an indication that the type of role model female teachers provide students with is different from the one male teachers provide.

Type of computer use

When considering the use of the computer at school, a number of activities can be identified which can be done with the computer. Chapter 3 dealt with the intensity of use for each of the activities. The first step in analysing a possible gender influence in this respect is answering the question whether female students, when they have access to computer at school, indicate doing the same activities (regardless of the intensity of doing these activities). Figure 6.9 shows the results for this question.

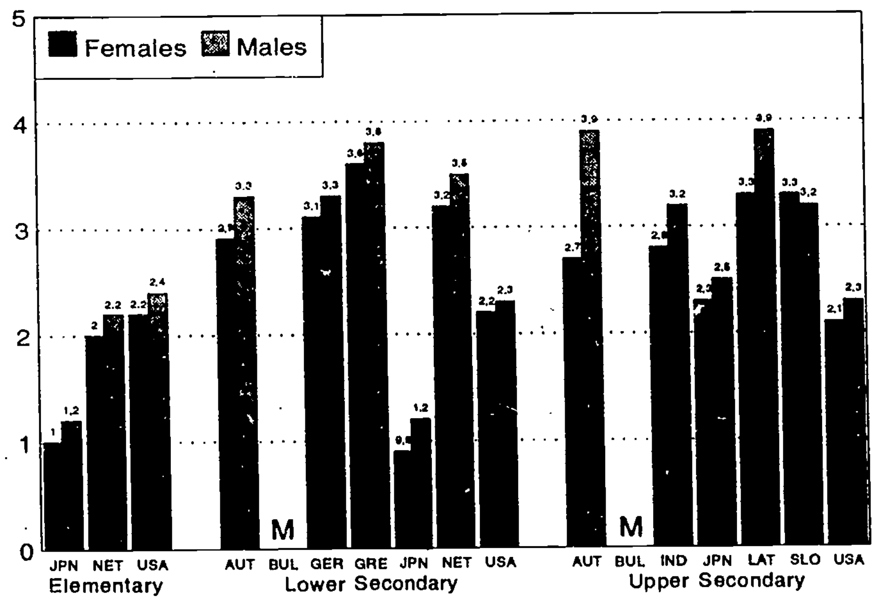


Figure 6.9 Mean number of activities carried out with the computer for female and male students who work with the computer at school or both at school and outside school.

It is clear that, on average, male students are engaged in a greater number of activities than females. Especially in Austria, India and Latvia in upper secondary education, these differences are notably large. Only in Slovenia in upper secondary education, female students indicate doing somewhat more activities with computers than males.

An inspection of the different types of activities for which the computer is used shows that in most countries males indicate on all activities a slightly higher percentage of being engaged in these activities. Only Germany and Greece in lower secondary education and Japan and Slovenia in upper secondary education are the countries in which females indicate relatively more use on many activities. Female students indicate a higher engagement in word processing especially in Japan, but also in Slovenia (upper secondary education).

Thus, a first conclusion is that female students, when having access to computers at school, are engaged in less activities than males. As an earlier conclusion was that computer use at school is especially important for female students in order to compensate for lack of outside school access, this new result might, to some extent, be troublesome because it indicates again a gender inequity, this time inside the school environment. However, further analyses are needed on the intensity of being engaged in these activities and gender differences in this respect. Therefore, the above conclusion is formulated with caution.

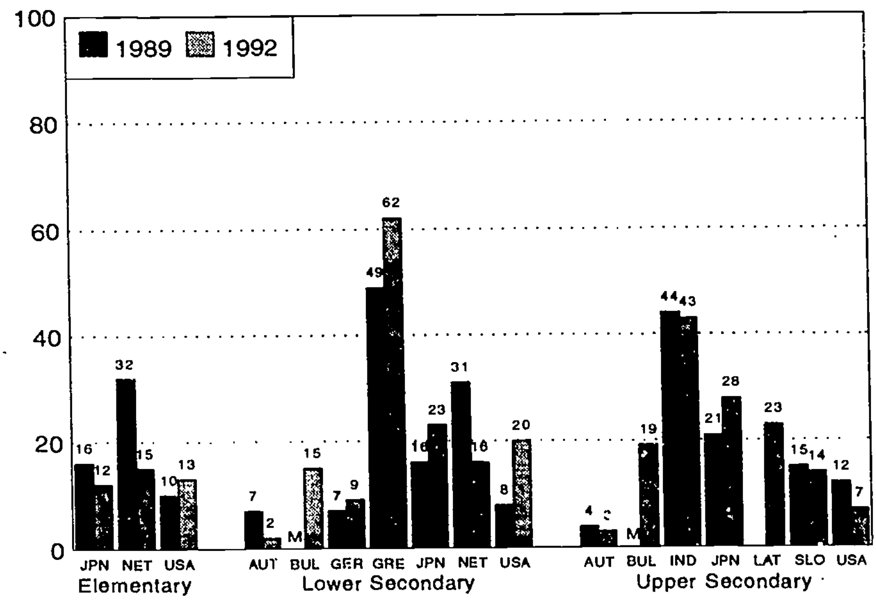
School gender policy

Given the earlier conclusion of the importance of 'in-school' access to computers for female students, it is interesting to look at the school environment in terms of their policies in this area.

Principals of co-educational schools were asked whether the school has a special policy for ensuring gender equity. It must be noted that in most countries, all computer using schools report being co-educational. Only in Bulgaria, India and Japan (upper secondary education), a group of schools ranging from 22% in Japan to 52% in Bulgaria in upper secondary education are found to be not co-educational. These percentages may refer to schools that are by policy especially for either boys or girls but it is also possible that schools are included in this percentage that, due to the type of education they offer, have only girls or boys. This is for instance possible in Industry courses in Japan (only male students) or business courses (only female students). This group of schools is excluded from the analyses in this section.

Figure 6.10 indicates the percentages of schools with a special gender policy for both 1989 and 1992. Since 1989, the percentage schools with a special gender policy did increase in most countries, except in Austria and the Netherlands. The large decrease in gender policy in the Netherlands in elementary education can be explained by the increase of the number of schools that use the computer. These 'new users' have to solve all kinds of problems related to the introduction of computers before they are ready to develop a special gender policy.

Greece is the exceptional country with a majority of schools indicating they have a special gender policy. No clear explanation can be given for this situation. Overall, the picture still holds that only a small minority of schools define a special policy in order to promote gender equity in the area of computer use. The impression is that the gender issue in the field of computer use is not considered to be of any importance in most schools. In this sense it is interesting to note that in the Netherlands computer use in general does not get a high priority in the weekly meetings of teachers in lower secondary education (Ten Brummelhuis, 1993), let alone the specific issue of gender and computer use.



Notes: M = information not available or too many missing cases (>20%).

Figure 6.10 Percent co-educational computer using school with special gender policy to ensure equity.

For schools having a gender policy, the question is what type of policies they have. Policies like training of female teachers in computer education, specific suggestions for teachers on how to promote equity, and in-service sessions for teachers about equity are mentioned. The number of schools with a special gender policy in most countries is so small that no further details on the type of policy are given in this report.

Conclusion

The findings of the Comped data seem to indicate that the concern of many educational practitioners about gender equity that computer use causes or preserves differences between female and male students is well founded. At the output level, results indicate that females know less about information technology, enjoy using the computer less than male students, and perceive more software problems. Possible causes of these differences as identified in this chapter deal with differences in parental support, access to computers (in terms of availability and use), amount of female role models and activities carried out with the computer at school.

But do the Comped data also provide some clues for possible ways to improve this situation? The first step might be to recognize that gender differences are found both outside and inside school. This means that both parents and teachers have to be made aware of this situation as the basis for action in reducing the difference. As indicated in the section above, a school's policy concerning the gender issue is rare, and when a school has such a policy, it is not directed towards the parents. Concerning the teachers, the perspective chosen by a majority of schools seems to be the stimulation of female role models, but making both female and male teachers aware of the gender difference between male and female students is done as well.

7

Summary and Clues for Future Analyses

In Chapter 1 the content of this book was outlined in the context of a summary of major finding from the 1989 survey of the Comped project. Below we will summarize the first results from the 1992 survey, amongst others in terms of the issues which were also distinguished in Chapter 1. The first analyses of stage 2 data resulted in many questions for further analysis. These questions can be the basis for more detailed analyses on the 1992 database, which will be included in later publications.

Hardware and software

In 1989 the USA was the only country, among all those participating in the study, where in all schools at the elementary and secondary level computers were available for instructional use. Since then an increasing number of schools in the other countries also acquired access to computers, but a substantial number of elementary schools in Japan (about 64%) and the Netherlands (17%), lower secondary schools in Bulgaria (17%) and Japan (29%), and upper secondary schools in India (85%) did not yet possess computers for instructional use in 1992.

In almost all countries the number of computers in schools increased considerably in three years time, but (except for Austria, Japan, and Slovenia) most equipment still consisted of quite old fashioned 8-bit machines. While most computer coordinators perceive the shortage of hardware less as a problem than in 1989, a majority of students (except for Japanese secondary and Dutch lower secondary schools) complains about computers not being available when they want to use them, although this problem does not occur very often.

Access to external networks is quite rare, except in the USA, Austrian upper secondary schools and Dutch lower secondary schools and regular use of networks occurs seldom (except for about 15% of the schools in the USA).

In some countries many students have access to computers at home. In Austria, Germany, the Netherlands, and the USA computers are available in roughly half or

This chapter was written by Willem J. Pelgrum, Ingeborg A.M. Janssen Reinen and Tjeerd Plomp.

more of the homes.

The availability of instructional tool software increased between 1989 and 1992, except in Greece, India, the Netherlands and Japanese upper secondary schools. Shortage of software is still seen as an important problem, although only slightly less than in 1989. In all countries a majority of students complain that programs are difficult to handle.

An important question remaining for future analyses is to what extent particular characteristics of the computer-infrastructure (in terms of hardware and software) in schools promote or inhibit the involvement, attitudes, knowledge, and skills of students with regard to computers. Also, the relation between this infrastructure and integration of computers in the curriculum needs further investigation.

Type of computer use

The most popular use of computers in schools is for teaching about computers and applications and how to handle them. Only a minority of students use computers regularly in subjects like mathematics, science and mother tongue.

Computer related curricula are quite different from country to country, but also within countries there exists a large variation between schools with regard to topics covered in teaching about computers.

Playing games is by far the most popular activity for pupils of elementary schools, inside as well as outside school, while at the secondary level more 'serious' activities like word processing and programming are practiced by students. Activities that indicate the use of computers for learning (new) subject matter, using computer assisted instruction (learning new material, doing drill & practice and taking tests), are practiced to a lesser extent.

Computer related activities of students inside school and outside school are correlated and the use of computers outside school for doing schoolwork increases as students go from elementary to upper secondary level. Thus, part of the use of computers outside schools is enhanced or motivated by what is done or learned at school.

Future analyses of the data will especially be directed at determining under which conditions the integration of computers in the school curriculum is fostered. These analyses could examine the influence of school level factors (like hardware and software provision and policies regarding computer use) on the types of computer use found among students and teachers. For instance, the question is to what extent an orientation to learning about computers and/or learning with computers is influenced by the type of equipment schools possess. Further analyses are needed to determine whether a more refined distinction within the global construct of *learning with computers* is possible.

Another intriguing problem is to identify factors inside and outside school that enhance the use of computers by students outside school. This could answer the question why in some countries the correlation between activities performed with the computer inside and outside school is so much higher than in other countries.

Knowledge and attitudes of students regarding computers

The opportunities students have for acquiring computer related knowledge and skills in formal courses at school differs quite substantially between as well as within countries. This is not directly reflected in the scores on the FIT-test. Although the low scores in *elementary schools* may be a reflection of the fact that formal teaching about computers hardly occurs at this level, in secondary education the picture is somewhat diffuse.

The highest scores on the FIT-test for students in *lower secondary schools* are found in Austria, Germany and the Netherlands; the scores for Greece and the USA are somewhat lower, while Bulgaria and Japan have the lowest average score. On the other hand, the opportunities for students to learn about the subject matter represented in the test at this level are the highest in Austria and Greece and the lowest in Bulgaria, Japan and the USA.

In upper secondary schools, the score of Austria is very high, Latvia, Slovenia and the USA are somewhat lower, and Bulgaria, India and Japan are the lowest. At this level again, the level of opportunity to learn indices do not directly match with the scores. Therefore, one may hypothesise that other factors than formal courses contribute to knowledge about new information technologies, such as outside school use or learning by doing.

Other results presented in Chapter 4 show that students seem to acquire a good deal of computer related knowledge outside school. Knowledge and attitudes of students are quite different for students with different amounts of exposure to computers. Most students strongly perceive computers as relevant for their future but do not always enjoy computer related activities. In a number of countries the encouragement by parents to use computers is quite low.

It is troublesome that quite a number of students tend to agree with unethical practices like the illegal copying of software. This raises the question to what extent schools and parents can play a role in making students more aware of the implications of such practices. Although in Chapter 3 it was noted that over the past few years schools tend to pay more attention to ethical issues in computer lessons, one may wonder whether this should be emphasized even more.

Further analyses regarding the generalizability and validity of the FIT-test in terms of the intended curriculum of countries are needed. Some first explorations regarding this question were promising: in the Netherlands curriculum experts concluded that the test fits well in the informatics curriculum of lower secondary schools. Furthermore, from further analyses it should be determined which factors (such as home background, motivation and curriculum offerings) are likely causes of differences with regard to students' basic understanding of information technology. Also the interpretation of the Opportunity to Learn data deserves careful attention.

Staff development

As most of the use of the computer in the countries included in this study is directed towards learning about the computer, the issue of staff development in this report is described from the perspective of those teachers who, in most countries, are responsible for teaching students about computers. These are in secondary education the computer education teachers and at the elementary school level all teachers in the sample. Although the knowledge and skill level of the teachers is quite high, a look into the wishes of teachers concerning teacher training shows that many teachers still indicate a lack of knowledge and a need for further training. This is in line with the innovation literature which indicates that the introduction of computers is a complex innovation with considerable changes for the teachers. One-shot training is not enough to make this innovation successful. Although most (computer education) teachers have had some form of teacher training in the field of computer use it is obvious that continuing attention for teacher training is important for all teachers. Furthermore, analyses of the support for teacher training at the school level reveal that the most available types of training at school deal with introductory courses and those directed towards the use of application programs. Whereas the expectation was that the computer coordinator could be an important person within the school setting to provide teachers with some kind of training, analyses showed that the ones selected for computer coordination are mostly regular teachers. The time they have for coordination tasks is primarily directed towards helping students. Helping teachers (and thus for instance training them informally about computer use) is a second coordination task, but not much of the available time is devoted to this.

These first analyses on staff development issues lead to the following two questions for further analyses. Given the differences in FITT score of students between the different countries, it would be good to study possible causes of these differences in the context of variations in staff development. The question is whether the amount and type of training teachers received is related to what teachers teach about computers and whether this factor is a possible contributor for explaining country differences in FITT.

A second question pertains to the relevance of staff development for the group of existing subject teachers who work with the computer. Although in many countries it was found that integration of the computer in the existing curriculum happens only to a small extent, there are indications that this type of computer use (learning with computers) will become more important in the future. Therefore, the role of teacher training in promoting a further integration of the computer in the school curriculum deserves attention in future analyses.

Gender equity

The data from 1989 the Comped study only allowed for studying the possible causes of gender inequity in terms of organizational variables, such as the existence of female role models, the nature of school policies concerning gender equity and the school organization in which students work. On these variables only small changes took place between 1989 and 1992. The student information in the 1992 data base allows for studying the actual situation of female and male students with regard to computer use (in terms of their knowledge in the domain of functional computer use, their attitudes towards this technology and the problems they experience). The analyses indicate that indeed a gender difference exists, not only with respect to their knowledge but also with respect to the attitudes and problems experienced by students.

In addition to the mere description in Chapter 6 of factors that have a potential influence on the differences in functional computer knowledge between female and male students, further analyses need to be carried out to determine to what extent each of these factors contribute to explaining differences and to what extent they are inter-related. However, it is already clear from the data presented in Chapter 6 that both inside school as well as outside school attention should be paid to this phenomenon. This type of information is a prerequisite for developing a concrete and clear strategy for improving the situation for female students, hopefully leading to a more gender equal situation of computer use in education.

Concluding remarks

This book contains a first disclosure of information collected in stage 2 of the IEA-Comped study. It was written shortly after the data of the participating countries were made available to the international coordinating center. Thorough analyses on these data have not yet been done and, hence, the presentation is mainly descriptive. Further analyses will be conducted in the near future in order to address issues related to the general question how in the future children's understanding and skills regarding new information technologies can be fostered. The questions raised in this book will serve as a guideline for conducting the first steps of these analyses, which will be published in articles in scientific journals and a research volume.

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Appendix 1

Names and Addresses of Participants

Name and addresses of participating institutions, General Assembly members and National Research Coordinators involved in stage 2 of the Computers in Education Study.

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Appendix 2

Sampling Information

The basis for all analyses consists of the data, collected from samples in the participating countries. The representativeness of the intended and realised sample determines the confidence one can have in the results of the analyses.
This appendix contains some general and some numerical information about this subject. Note that we distinguish between the representativeness of the intended sample and of the realised sample (the respondents).

It also should be noted that for data on school- and student level weights have been computed, based on sampling information per school and the sampling procedure used in general within a system. Almost all analysis have been based on weighted data. For the teacher data no weights have been used.

This appendix consists further of the following information:

- System description (population definitions; stratification and selection; link with stage 1 sample; special computation of weights; representativeness of the sample).
- Sampling information tables (summary information about population, selection process and response rates).
- Number of cases per educational system and category of respondents; target grade information.
- Comparability across countries and non-response bias.

Appendix 2.a System Description

Austria

Population 2 (lower secondary education).

Population definition:

All schools of general education (grade 5 to 8) covering 95% of the age cohort. Special schools for handicapped students are excluded (5%). All students are in grade 8.

Stratification and selection:

2 strata based on school type (70% Hauptschule, 30% AHS-Unterstufe).

Internally there has also been stratified on Bundesländer (9).

Nearly 100% overlap with stage 1 sample (total sent schools 334: 225 stage 1 user + 109 stage 1 non-user, 235 stage 1 respondent schools + 99 non-respondent schools).

Population 3 (upper secondary education).

Population definition:

All schools of general and vocational higher education (grade 9 to 12/13), leading to "Matura"/qualifying for tertiary education and covering nearly 40% of the age cohort. Population 3 students (penultimate year) are in grade 11 (general higher) or grade 12 (vocational higher schools). Excluded are: special schools for handicapped students, medium vocational schools, schools for working persons, night-schools; part-time schools for apprentices are not defined as upper secondary schools.

Stratification and selection:

5 strata based on school type (general, technical, business, commercial, agricultural higher schools).

Big overlap with stage 1 sample (included are also non-response schools of stage 1).

Bulgaria

Population 2 (lower secondary education).

Population definition:
All schools except special education (handicapped etc.).

Stratification and selection:
3 strata based on size of settlement.

Population 3 (upper secondary education).

Population definition:
All schools (general and vocational).

Stratification and selection:
3 strata based on size of settlement.

Germany

Population 2 (lower secondary education).

Population definition:
All schools in 9 out of 11 states (Bundesländer) from the western part of the Germany (58% of all students). Excluded are the schools in the former DDR.

Stratification and selection:
3 strata based on school type.

The selected schools are the same as in stage 1, with a few additional new schools. From the selected students 42% is in the target grade (grade 8), the others are mainly in grade 9.

Representativeness of the sample:
The sample is assumed to be representative for West Germany. The 9 out of 11 states participating in the study are representing typical features of West Germany (geographical distribution of cities, political, economical). Analysing differences on critical variables (hardware-, software-equipment, computer use) for the 9 states no significant differences are found between the states. The major variance is due to

differences in schools.

Greece

Population 2 (lower secondary education).

Population definition:
All computer-using public schools. Excluded are all non-using public schools & all private, evening schools and schools for handicapped students.

Stratification and selection:
14 strata based on settlement and at the same time on the educational profile of the school's region. The educational profile of each region depends on the total number of students in grade 12 of the region. (The stratification is similar to the stratification of Comped, stage I)

Representativeness of the sample:
The sample is only representative for computer using schools.

India

Population 3 (upper secondary education).

Population definition:
All schools.

Stratification and selection:
The schools were randomly selected from 32 strata, based on state & district/city (8) * computer user (Y/N: 2) * participation in stage 1 (Y/N: 2). The districts were randomly chosen (about 30%) from the four selected States (out of 24 States), viz Utter Pradesh, Maharashtra, West Bengal and Tamil Nadu (respectively representing the regions North, West, East and South), and one Union Territory of Delhi (out of 7 U.T.s) falling in the North region of the country.

There is some overlap in schools with stage 1 (these schools are in separate strata, as indicated).

Representativeness of the sample and data quality:

The selected States & U.T. are considered to be representative for all States & U.T.s.

The data were collected by administrating bilingual (English and Hindi/Marathi/Bengali/Tamil) tools in view of the suitability and convenience of the respondents. Further, in view of the wide spread of schools and lack of fast communication facilities the tools were administered through personal visits by trained investigators. This approach has resulted in the substantially high response rate of 90% and a high quality of the data.

Special computation of weights:

The selection probabilities of districts within States have been taken into account in the computation of weights.

Japan

Population 1 (elementary education).

Population definition:

All schools except special education.

Stratification and selection:

9 strata based on size of settlement (3) * school size (3).

The selected schools are the same as in stage 1. The schools to which instruments have been sent is a subsample of these.

Special computation of weights:

The weights are based on selection probabilities in stage 1.

Representativeness of the sample:

The sample is considered to represent the target population because:

- The selected schools were distributed in almost all prefectures in each population.
- The schools are extracted out of all establishments, although they did not include new schools since stage 1 because the number of students has been decreasing and very few schools were established recently.
- Judging from the data on computer holding schools in the Ministry of Education, the percentage of computer using schools in the Comped study shows a reasonable value.

Population 2 (lower secondary education).

Population definition:
All schools except special education.

Stratification and selection:
9 strata based on size of settlement (3) * school size (3).
The selected schools are the same as in stage 1. The schools to which instruments have been sent is a subsample of these.

Special computation of weights:
The weights are based on selection probabilities in stage 1.

Representativeness of the sample:
As in population 1.

Population 3 (upper secondary education).

Population definition:
All general and vocational schools.

Stratification and selection:
15 strata based on establishment, course & ratio of students entering tertiary schools.
The selected schools are the same as in stage 1. The schools to which instruments have been sent is a subsample of these.

Special computation of weights:
The weights are based on selection probabilities in stage 1.

Representativeness of the sample:
As in population 1.

Latvia

Population 3 (upper secondary education).

Population definition:
All general secondary schools except special education (handicapped etc.).

Stratification and selection:
4 strata based on settlement (Capital Y/N) * language of instruction (Latvian/ Russian).

Representativeness of the sample:
The sample is considered to be representative for the target population, because the schools were distributed over the whole territory of Latvia.

The Netherlands

Population 1 (elementary education).

Population definition:
All schools except special education.

Stratification and selection:
3 strata based on number of target grade students per school.
The selected schools are the same as in stage 1, with a few additional new schools.

Population 2 (lower secondary education).

Population definition:
All schools except (5% of all students) international transition year, English stream, individual agricultural education, agricultural education and nautical education.

Stratification and selection:
12 strata based on school type (4) * school size (3).
The selected schools are the same as in stage 1, with a few additional new schools.

Representativeness of the sample:
The sample is considered to be representative for the target population, because the

schools were distributed over the whole territory of the Netherlands.

Slovenia

Population 3 (upper secondary education).

Population definition:
All 4-year schools.

Stratification and selection:
15 strata based on Computer-Education groups. The definition of school is a group of classes in the same school building with the same Computer-Education curriculum, so there may be more than one school within one building. All schools have been selected.
School codes are not the same as in stage 1.

Representativeness of the sample:
All schools have been selected. In each school one class in penultimate grade was randomly selected. The response rates are more than 80 %. So in fact, we are dealing with data representing the whole population of students.

USA

Population 1, 2 & 3.

Population definition:
All U.S. schools, public and private, that contained one or more of the three target grades of 5th, 8th or 11th grade plus vocational and "alternative" high schools. This frame excluded schools containing only 6th or only 9th grade, separate schools for the special education population and schools that only exist to provide part-day or part-year pull-out classes for students from other schools.

Stratification and selection:
The US sample was a sub-sample of the IEA Comped Stage 1 sample with slight adjustments to the sampling frame as well as a sample from schools newly opened since the Stage 1 study. Each school was allocated to one or more of three sub-frames, "primary", "lower-secondary", and "upper secondary", depending whether it

contained a 5th grade, 8th grade, or 11th grade.

In Stage 1 there were 81 strata within each population defined by enrollment, ratio of students per computer, size of metropolitan area community and district poverty level.

For Stage 2, half of the schools were sampled from each of the 81 strata from stage 1 and two additional strata were created for schools opened since Stage 1.

Special computation of weights:

Computation of weights took place in the USA with assistance from Westat Inc.

Representativeness of the sample:

The U.S. stage 2 sample is representative of all U.S. schools except for those schools with only 6th or only 9th grade. These two types of schools, however, make up a tiny fraction of all U.S. schools. To further investigate the representativeness of the Stage 2 sample, it was compared to a 10% simple random sample from the 1992 Quality Education Data Inc. (QED) database of schools. QED's database is a census of all U.S. schools and is the most up-to-date source of U.S. educational data. These comparisons of key indicators such as school and community type, enrollment, and number of computers found no systematic biases between the QED data and the IEA Stage 2 sample.

Appendix 2.b Sampling Information Tables

General remarks regarding the tables

'Selected schools' = Schools selected for the screening survey, which was intended to invite schools for participation and to collect data regarding use/non-use, teacher names, etc. (deviation: for Japan, these numbers include more schools, i.e. all schools which participated in stage 1).

'Sent schools' = To these schools all questionnaires have been sent.

'Received schools' = At least one questionnaire has been received from that school.

'Received classes' = At least one student questionnaire has been received from that school.

Formulas used to compute rates:

School participation rate = (selected schools willing to participate) / total selected (= use + non-use + non response) schools.

School return rate = total received schools/ total sent schools.

School response rate = total received schools/ total selected schools (except for Japan, where it equals the return rate).

The rates for students are also on school level and not on student level!

Student return rate = total received classes/ total sent schools.

Student response rate = total received classes/ total selected schools (except for Japan, where it equals the return rate).

Missing information, (M) may be due to

- Missing or unreliable information (e.g. number of students).
- Undefined rates.

Sampling methods:

PPS = Probability Proportional to Size.

EP = Equal Probability.

Other = Adapted Equal Probability.

Appendix 2.b

Sampling tables elementary schools

	JPN	NET	USA
Number of strata	9	3	83
Number of schools	24023	8332	56427
Number of students	1524600	164759	3479597
PPS(1), EP(2) or Other(3)	2	2	1
Total selected schools	400	800	247
Willing to partic.	M	294	210
Total sent schools	200	294	210
Total received schools	197	277	209
Total received classes	192	172	188
School partic. rate	M	.37	.85
School return rate	.99	.94	1.00
Student return rate	.96	.59	.90
School response rate	.99	.35	.85
Student response rate	.96	.22	.76

Notes: NET: See the text on representativeness for student rates.

USA: In the USA the actual numbers of schools and students are slightly higher than the presented numbers, because from a few strata the numbers are missing.

Appendix 2.b

Sampling tables lower secondary schools

	AUT	BUL	GER	GRE	JPN	NET	USA
Number of strata	2	3	3	14	9	12	83
Number of schools	1428	2993	5811	407	11198	2084	34199
Number of students	331831	120662	2367000	40937	1722928	185210	3228499
PPS(1), EP(2) or Other(3)	2	2	2	1	2	2	1
Total selected schools	630	443	330	155	400	924	233
Willing to partic.	305	315	325	M	M	446	196
Total sent schools	334	397	325	155	200	446	196
Total received schools	299	268	170	137	191	421	196
Total received classes	291	151	87	137	187	233	171
School partic. rate	.48	.71	.98	M	M	.48	.84
School return rate	.90	.68	.52	.88	.96	.94	1.00
Student return rate	.87	.38	.27	.88	.94	.52	.87
School response rate	.47	.60	.52	.88	.96	.46	.84
Student response rate	.46	.34	.26	.88	.94	.25	.73

Notes: GER and NET: See the text on representativeness for student rates.
USA: In the USA the actual numbers of schools and students are slightly higher than the presented numbers, because from a few strata the numbers are missing.

Appendix 2.b
Sampling tables upper secondary schools

	AUT	BUL	IND	JPN	LAT	SLO	USA
Number of strata	5	3	32	15	4	15	83
Number of schools	475	976	4908	10057	377	171	18415
Number of students	131841	113263	M	1790614	10589	4570	2377268
PPS(1), EP(2) or Other(3)	2	2	3	2	1	2	1
Total selected schools	268	305	500	809	200	171	215
Willing to partic.	183	230	450	M	175	147	174
Total sent schools	184	289	450	200	175	147	174
Total received schools	174	204	450	184	153	144	174
Total received classes	172	134	450	160	152	137	153
School partic. rate	.68	.75	.90	M	.88	.86	.81
School return rate	.95	.71	1.00	.92	.87	.98	1.00
Student return rate	.93	.46	1.00	.80	.87	.93	.88
School response rate	.65	.67	.90	.92	.77	.84	.81
Student response rate	.64	.44	.90	.80	.76	.80	.71

Notes: IND: The number of schools is the total number within the selected districts/ metropolitan cities; the total for the whole country is approximately 19000.

USA: In the USA the actual numbers of schools and students are slightly higher than the presented numbers, because from a few strata the numbers are missing.

Appendix 2.c Number of Cases per Educational System and Category of Respondents

In the following table 'Schools' indicates that at least one questionnaire has been returned from a school. The categories '(computer-) using', 'non-using' and 'undetermined' have first been determined per instrument (except for Opportunity to Learn) and if the information from at least one instrument per school indicates computer use, the school has been defined as a using school. There are some inconsistencies in the answers given by the various respondents from a school on the questions about computer use, which may e.g. cause that a principal has been coded as 'non-using', whereas the school as a whole has been coded as 'using'.

The target grades for students are:

- For elementary schools: students in the grade in which the modal age is 10 years in the middle of the school year.
- For lower secondary schools: students in the grade in which the modal age is 13 years in the middle of the school year.
- For upper secondary schools: students in the penultimate year of secondary education (which may result in different grades for different school types within a country).

The fact that for elementary schools and lower secondary schools the mean age at the test date is over a year higher than the indicated modal age does not contradict the given definition, as the computation of the mean was based on the age in months and as students who fail to pass have an upward effect on the mean age, but hardly on the modal age. The target grades for each system are included in the table.

For the analyses in this report for primary schools and lower secondary schools only the students from the target grades have been selected. Only those numbers of students are mentioned below. These numbers are for some systems 100% of all students from which data have been collected, for some others between 90% and 100% and for Germany about 42%.

The numbers presented here are unweighted numbers, whereas in the report (e.g. Figure 2.1 and Table 2.1) weighted numbers are used, which will be different, especially if using schools are overrepresented in the data (mainly India and Japan). Another difference may be caused by the fact that there was insufficient information from some schools to compute weights and those schools have been excluded (mainly Japan, Austria, Germany and the school questionnaires from the USA).

Number of cases per educational system and category of respondents

Elementary Schools	JPN	NET	USA
Schools			
using	135	239	209
non-using	62	38	0
undetermined	0	0	0
Principals			
using	123	207	204
non-using	66	43	3
undetermined	3	5	0
Coordinators			
using	95	208	156
non-using	20	21	7
undetermined	7	15	44
Teachers			
using	79	94	0
undetermined	0	3	0
Opportunity to learn			
using school	0	142	186
non-using school	0	14	0
Students			
no computer use	1799	420	25
use only outside	1593	1048	303
use only at school	1218	390	470
at school & outside	1492	1763	3528
Target grade	5	5	5
Mean age at test date	11.5	11.3	11.2

Notes: JPN: Students did not participate in FIT-test.

Number of cases per educational system and category of respondents

Lower Secondary Schools	AUT	BUL	GER	GRE	JPN	NET	USA
Schools							
using	299	222	168	137	165	420	196
non-using	0	46	2	0	26	1	0
undetermined	0	0	0	0	0	0	0
Principals							
using	272	153	149	126	151	336	193
non-using	0	39	2	8	30	2	0
undetermined	5	5	0	0	3	5	1
Coordinators							
using	285	133	152	129	137	366	137
non-using	0	11	1	0	23	0	7
undetermined	0	8	0	2	5	5	48
Computer teachers							
using	267	91	70	251	87	232	0
non-using	0	52	0	0	3	0	0
undetermined	1	13	0	1	1	0	0
Opportunity to learn							
using school	241	76	161	132	161	211	2
non-using school	0	9	2	0	23	1	0
Students							
no computer use	224	951	148	122	2197	296	108
use only outside	332	429	251	39	1205	904	86
use only at school	1788	418	312	1527	1810	789	750
at school & outside	3899	356	1010	2067	1451	2922	2809
Target grade	8	8	8	9	8	8	8
Mean age at test date	14.3	14.7	14.7	14.7	14.5	14.4	14.2

Number of cases per educational system and category of respondents

Upper Secondary Schools	AUT	BUL	IND	JPN	LAT	SLO	USA
Schools							
using	174	199	271	175	153	131	174
non-using	0	5	179	9	0	13	0
undetermined	0	0	0	0	0	0	0
Principals							
using	168	149	268	166	129	92	173
non-using	0	9	182	9	1	1	0
undetermined	2	4	0	2	8	0	0
Coordinators							
using	171	137	257	159	139	92	136
non-using	0	2	5	9	1	1	3
undetermined	0	3	6	4	1	1	33
Computer teachers							
using	0	149	179	113	145	38	0
non-using	0	7	0	0	0	0	0
undetermined	0	2	0	0	2	24	0
Opportunity to learn							
using school	152	97	179	172	146	50	3
non-using school	0	1	0	8	0	1	0
Students							
no computer use	238	385	9794	2089	428	756	84
use only outside	262	36	657	905	92	450	39
use only at school	946	1319	2162	1804	1174	943	590
at school & outside	1956	429	947	1501	620	1296	2336
Mean grade	11.6	10.1	12.0	12.0	11.2	11.0	11.0
Mean age at test date	18.1	M	17.1	17.5	17.0	17.7	17.1

Appendix 2.d Comparability Across Countries and Non-response Bias

General considerations[1]

In order to justify the use of data from different sources in a comparison of results it is necessary to apply a common, or at least minimally acceptable, set of standards to all these sources. At the design stage of the IEA Comped study, the common criterion was specified to be an overall response rate of 80% for each study that would be included in the cross-national comparisons.

Any non-response is a cause for concern as it is not possible to be certain that the non-responding part of the sample would have given responses similar to those of the responding part; therefore there is scope for bias in the results. If, however, for a properly designed probability sample, a sufficiently high response rate is obtained then the achieved sample is likely to mirror reasonably well the characteristics of the whole population even if there are some differences between the responders and the non-responders. This is why a single criterion, such as a response rate, may be an adequate criterion in itself.

Based on the experience of previous IEA studies, the cutoff level of 80% was judged to be a realistic level of response rate to demand of a professionally thorough data collection operation in this context. Two factors combined undermine the basis for this judgement. First, in the central and eastern European countries that had centralized educational systems a response rate of 100% had been the norm; the transition to less centralized systems brought with it a sudden and drastic drop in response rates. Second, in many other countries response rates dropped also for a variety of reasons, perhaps including the substantial increase in the number of surveys of schools and therefore in the demands of surveys on the time of teachers and school administrators. As a result of both these factors, many more surveys than expected failed to meet the response rate criterion.

Once the response rate falls below some threshold - and whatever threshold is used there will be an arbitrary element to it - then if the data are to be used at all some other criteria must be used to validate them. The two elements of this validation should be: (i) monitoring the process by which the data are collected; and (ii) carrying out whatever post-survey analyses that are possible in order to check the 'representativeness' of the data collected. Both these elements should indeed be present in all survey evaluations, but their importance is inversely proportional to the response rate achieved.

[1] By Colm O'Muircheartaigh

A professional survey researcher would look not only at the response rate, but at how this response rate was achieved and at how the responders corresponded to the population as a whole in terms of known characteristics. Among the criteria to be used would be:

(i) The efforts made to obtain responses: it is well known in survey research that there tends to be a difference between the responses of enthusiastic responders on a topic and the responses of more reluctant responders.

Thus it is necessary to make substantial efforts to raise the response rate beyond that which would be obtained from the first request for cooperation. In the field of household surveys, at least three call- backs would normally be expected for face-to-face or telephone interviews; in mail surveys three mail reminders would be the norm, preferably followed up by a telephone or face-to-face approach. If cost is the overriding consideration, the more expensive stages could be carried out on a (random) subsample of the non-responders.

(ii) Comparison with known characteristics of the population:

There is normally a good deal of information available about the structure of the population and the distribution of various characteristics of the population. There will also be available, in the case of a multi-phase study such as Comped, information from the earlier phases (or stages) which will make it possible to estimate whether non-response is likely to have a deleterious effect on the results of the survey and the interpretation of these results. For Comped we might, for instance, look at the proportions of using and non-using schools or the proportions of large and small schools - as identified in the screening survey - that responded to the later stages of the survey.

Non-response analyses on the Comped data

As for the Comped study stage 2, the participating countries have focussed on both criterion (i) and (ii) above.

On criterion (ii) response analyses have been carried out for countries with low response rates. In Appendix 2.b some samples show response rates substantially below 80%: elementary schools in the Netherlands; lower secondary schools in Austria, Bulgaria, Germany and the Netherlands. Therefore some additional information that sheds light on the quality of these samples is included below.

Austria

The samples of lower and upper secondary schools in stage 2 were the same as the samples of schools originally invited to participate in stage 1 of the study.

On the stage 2 data, the schools which participated (also) in stage 1 and the schools which did not participate in stage 1 were compared on a number of crucial variables (number of computers, mean of FIT-test, etc.) These analysis showed that, at least on these variables, the non-respondent schools in stage 1 did not differ from the respondents in stage 1. Although there is no guarantee that the stage 2 sample is representative and although this is in fact a non-response analysis for stage 1, the results provide some grounds for having confidence in both the stage 1 as the stage 2 data.

The lower participation rate of urban districts is compensated through weighting.

Bulgaria

After an initial response rate of about 40% for each population a random subsample of about 80 schools per population has been drawn from the non-respondents. These schools have been visited almost a year later. This resulted in a 100% participation for the subsample.

The original respondents and the additional ones were compared on several variables from different instruments (FIT-test, student attitude scales and all variables involved in analyses for Chapter 3). These analysis showed that there is no systematical bias on these variables between the early responders and the visited schools. The analysis made give ground for confidence that the participation schools (both early and late) also will not be different from the non-participating ones.

Germany

No further non-response analyses have been done, as there are no data available for this purpose.

N.B.

In the used student-datafile for Germany only the target grade students have been selected. There were many schools where a different grade had been selected. The actual student rates based on all received data are close to the school rates.

The Netherlands

From the screening survey information on key-variables is available for all selected schools. A chi-square test on denomination/school type, school size and region (amongst others) showed that on these variables there is no bias between the participating and the non-participating schools. The most important reasons for schools not to participate in this study were lack of time and an overload of requests to participate in other research.

Representativeness for student rates

In the screening survey schools were asked to participate on student level in the study. In pop 1 (elementary schools) from the 294 participating schools 194 schools (66%) were willing to participate on student level and 172 schools returned the completed student materials (return rate 89%). In pop 2 (lower secondary) from the 446 participating schools 283 schools (64%) were willing to participate on student level and 233 schools returned the completed student materials (return rate 82%).

To investigate the representativeness of the student results a comparison was made on school size and school type between the participating schools and the non-participating schools. A chi-square test indicated on none of the variables a systematic bias between participating and non-participating schools.

USA

Although the USA has response rates well above 80%, there has been done a non-response study. Comparison of the same key indicators as in the tests on representativeness of the sample (see Appendix 2.a) were made between responding and non-responding schools to test for non-response bias using QED data. No systematic biases were observed.

Appendix 3

Perceived Problems

Percentage computer coordinators perceiving major problems in 1989 and 1992

	JPN		NET		USA	
Elementary	89	92	89	92	89	92
Insufficient computers available	64	32	81	66	65	41
Insufficient peripherals available	58	18	37	22	56	33
Difficulty with maintenance	33	30	2	5	13	5
Limitations of computers	30	23	31	30	23	17
Not enough software for instruction	95	54	69	45	48	14
Software too difficult	40	26	17	9	5	1
Software not adaptable enough	70	33	40	28	14	3
Poor quality of manuals	56	18	18	13	15	7
Lack of information about software	73	35	21	21	18	6
Software not in instruction language	25	5	4	4	-	-
Not enough supervising help	43	20	34	32	35	29
Integration in instruction problems	58	47	43	40	52	40
Teachers lack knowledge	84	33	46	51	79	40
Insuff. expertise to help teachers	72	21	38	38	33	22
No room in time-table to learn about	47	32	28	20	12	39
Not enough computer location space	25	21	36	23	27	31
Insuff. techn. operating assistance	70	35	15	19	15	18
Problems scheduling enough time	43	16	27	33	31	28
Insuff. access for own use teacher	38	28	8	11	12	10
Insufficient training opportunities	87	40	24	22	41	30
Lack of administrative support	47	22	10	23	15	16
Inadequate financial support	68	51	48	56	37	37
Not enough time to develop lessons	84	49	57	60	62	51
Teachers lack interest	33	14	21	21	44	21

Notes: - = information not available. difference in wording of 1989 and 1992 questions: 1989 = 2 categories for serious problems: checked / not checked. 1992 = 3 categories for seriousness of problems: not at all / minor / major.

Percentage computer coordinators perceiving major problems in 1989 and 1992

	AUT		BUL	GER		GRE		JPN		NET		USA	
Lower Secondary	89	92	92	89	92	89	92	89	92	89	92	89	92
Insuff. computers	53	22	47	40	17	39	57	74	26	50	26	63	47
Insuff. peripherals	35	16	58	39	13	57	50	71	26	31	15	50	39
Diffic. maintenance	18	18	66	25	16	40	48	34	11	24	18	18	12
Limitations comp.	39	47	64	49	33	14	64	32	21	21	43	27	32
Insuff. instruc. softw.	89	45	64	63	40	81	74	97	61	73	46	54	34
Software difficult	22	15	24	21	17	11	20	54	22	42	27	4	3
Software not adapt.	31	23	33	17	22	38	56	76	45	42	41	24	11
Poor qual. manuals	33	25	47	34	30	64	57	58	27	16	18	16	14
Lack info. software	40	33	47	41	35	62	61	79	32	29	26	16	18
Softw. not instruct. language	13	6	30	7	6	71	58	22	5	10	8	-	-
Not enough superv.	21	12	12	15	16	30	34	53	30	29	26	32	34
Integration instruct.	52	46	40	77	70	53	61	65	36	60	69	46	54
Teachers lack knowl.	75	65	58	-	75	47	61	86	52	71	74	72	49
Insuff. exp. help	41	42	59	18	53	73	58	74	37	40	55	26	24
Insuff. time learn about	30	35	26	50	47	44	69	69	30	43	27	12	44
Computer location	22	18	21	13	16	13	30	45	11	11	16	26	32
Techn. operat. ass.	15	13	49	31	25	44	57	72	24	29	19	23	25
Schedule time	30	19	17	17	33	22	57	61	24	32	32	32	36
Access teachers	13	5	13	7	18	19	24	54	31	13	14	16	18
Insuff. training	29	27	44	-	22	84	78	87	52	19	21	50	43
No admin. support	25	20	41	19	29	48	62	54	29	14	22	14	15
Inadeq. fin. supp.	39	38	79	36	41	59	78	81	48	34	40	34	44
Time develop less.	31	32	42	2	38	62	75	89	62	73	71	61	65
Teach. lack inter.	51	54	42	63	64	36	45	35	19	42	61	46	28

Notes: - = information not available, difference in wording of 1989 and 1992 questions; 1989 = 2 categories for serious problems: checked / not checked, 1992 = 3 categories for seriousness of problems: not at all / minor / major.

Percentage computer coordinators perceiving major problems in 1989 and 1992

	AUT		BUL	IND		JPN		LAT	SLO		USA	
Upper Secondary	89	92	92	89	92	89	92	92	89	92	89	92
Insuff. computers	51	27	50	72	38	66	35	36	60	48	56	40
Insuff. peripherals	21	10	62	45	32	64	23	32	44	27	37	29
Diffic. maintenance	13	26	74	44	34	34	14	42	36	9	17	11
Limitations comp.	46	49	70	23	21	43	30	74	62	24	31	30
Insuff. instruc. softw.	75	50	67	66	42	90	51	63	81	32	44	32
Software difficult	10	7	21	17	14	41	13	4	8	3	4	3
Software not adapt.	18	20	28	35	27	73	39	33	30	4	19	15
Poor qual. manuals	35	32	45	21	21	57	22	64	25	21	15	10
Lack info. software	35	34	46	32	26	73	23	55	44	17	13	16
Softw. not instruct. language	8	6	31	36	34	26	10	31	31	24	-	-
Not enough superv.	20	21	13	37	27	59	28	10	18	29	26	34
Integration instruct.	42	48	53	50	38	56	21	35	40	25	41	53
Teachers lack knowl.	52	54	66	41	33	76	32	56	61	54	68	57
Insuff. exp. help	53	41	57	54	37	68	23	55	69	44	22	24
Insuff. time learn about	34	38	35	47	40	48	27	8	5	14	6	34
Computer location	25	24	26	23	23	37	18	19	19	16	28	29
Techn. operat. ass.	8	16	53	38	33	63	32	31	29	19	17	25
Schedule time	33	21	21	50	35	55	27	18	29	40	28	34
Access teachers	17	10	19	25	28	42	27	16	14	13	18	18
Insuff. training	26	32	44	62	49	82	43	35	21	15	45	36
No admin. support	31	22	45	31	34	51	24	13	11	13	9	17
Inadeq. fin. supp.	45	51	75	42	46	80	62	78	53	72	34	47
Time develop less.	38	42	46	67	40	89	54	35	30	33	62	63
Teach. lack inter.	36	40	49	17	19	29	16	39	30	29	46	36

Notes: - = information not available, difference in wording of 1989 and 1992 questions; 1989 = 2 categories for serious problems: checked / not checked, 1992 = 3 categories for seriousness of problems: not at all / minor / major.

Appendix 4

Software Availability

Percentage of computer coordinators indicating availability of types of software, 1989 versus 1992

	JPN		NET		USA	
Elementary	89	92	89	92	89	92
Drill and practice programs	89	61	82	80	98	96
Tutorial programs	54	32	43	46	85	90
Word processing/desk top publishing	76	77	87	89	82	96
Painting or drawing programs	76	64	54	68	39	59
Music composition programs	32	33	18	11	19	21
Simulation programs	37	34	20	22	48	57
Recreational games	43	36	76	80	60	68
Educational games	38	39	94	88	90	96
Programming languages	53	62	25	12	34	32
Spreadsheet programs	47	62	31	22	44	61
Mathematical graphing programs	18	16	23	20	37	43
Statistical programs	26	27	8	5	13	16
Database programs	27	53	45	36	51	61
Lab interfaces: data acquisition	1	1	2	6	2	11
Programs to control devices/equipment	2	3	0	1	11	13
Programs to control interactive video	6	2	0	0	3	9
Comp. aided design/manufacturing	3	1	0	0	3	8
Authoring programs CAI lessons	56	51	1	4	6	11
Item banks for test construction	3	6	12	8	19	35
Recording & scoring tests	14	21	22	20	29	32
Gradebook programs	50	52	10	13	54	66
Computer communication programs	9	15	6	8	8	13
Tools and utilities	26	23	30	40	40	53

Percentage of computer coordinators indicating availability of types of software, 1989 versus 1992

	AUT		BUL	GER		GRE		JPN		NET		USA	
Lower Secondary	89	92	92	89	92	89	92	89	92	89	92	89	92
Drill and practice	68	94	55	67	88	5	21	62	60	72	85	93	95
Tutorial programs	49	85	62	26	41	14	21	37	46	80	85	79	93
Word processing	95	100	60	88	94	84	88	70	84	98	100	92	99
Painting or drawing	58	80	49	36	45	9	15	70	81	62	58	47	58
Music composition	12	18	35	4	9	5	4	11	20	7	8	25	21
Simulation	30	53	10	33	41	2	3	42	57	58	68	54	66
Recreational games	62	88	71	30	56	23	22	29	27	60	54	68	88
Educational games	46	90	43	21	54	9	12	22	32	71	74	93	97
Progr. languages	91	94	61	99	18	86	96	66	81	67	65	43	53
Spreadsheet	90	99	40	66	78	67	45	69	89	92	93	54	81
Math. graphing	31	30	24	50	56	6	9	29	47	74	77	37	56
Statistics	21	35	12	15	24	6	9	39	41	48	31	16	19
Database	83	88	28	64	72	76	75	56	69	92	91	56	79
Lab interfaces	0	2	1	18	21	2	0	3	4	16	33	8	9
To control devices	12	15	9	24	33	2	0	1	8	22	35	10	15
To control int. video	0	2	0	0	2	2	0	4	7	0	0	4	12
CAD/CAM	43	66	5	4	9	2	3	6	9	16	28	11	20
Authoring programs	9	23	11	6	12	2	1	54	70	81	65	10	11
Item banks	4	9	3	1	7	3	7	6	3	30	53	22	32
Record/score test	3	7	14	1	7	13	5	16	16	26	32	32	39
Gradebook programs	15	38	3	1	4	2	16	81	72	42	66	61	65
Comp. communic.	9	15	4	8	17	3	5	11	13	25	46	12	15
Tools and utilities	36	65	23	29	48	29	29	34	36	57	81	42	60

Percentage of computer coordinators indicating availability of types of software, 1989 versus 1992

	AUT		BUL	IND		JPN		LAT	SLO		USA	
Upper Secondary	89	92	92	89	92	89	92	92	89	92	89	92
Drill and practice	64	58	60	71	50	40	42	88	52	79	87	90
Tutorial programs	61	70	68	56	44	23	28	90	28	73	87	91
Word processing	97	100	63	90	71	69	74	87	88	99	99	100
Painting or drawing	36	73	56	55	40	49	63	82	72	62	51	72
Music composition	6	6	34	51	34	6	10	36	5	8	27	41
Simulation	26	51	11	63	29	28	28	21	17	30	57	68
Recreational games	44	63	75	73	59	24	20	94	71	73	61	84
Educational games	21	68	47	66	57	16	22	81	30	46	84	94
Progr. languages	93	100	71	77	57	75	86	88	85	100	73	77
Spreadsheet	84	99	52	66	47	71	90	90	49	99	90	98
Math. graphing	35	69	30	71	47	21	27	42	33	58	53	73
Statistics	20	49	14	44	31	32	23	26	21	41	27	42
Database	85	97	37	73	51	58	66	84	67	91	83	93
Lab interfaces	7	10	4	8	10	3	6	3	10	16	18	22
To control devices	25	32	16	8	10	7	7	13	5	7	17	17
To control int. video	1	2	1	3	4	2	3	7	0	0	11	28
CAD/CAM	16	30	5	11	7	16	18	2	10	20	28	47
Authoring programs	11	15	13	6	6	36	43	13	5	6	21	27
Item banks	3	6	7	19	15	3	9	7	11	9	38	64
Record/score tests	3	6	19	16	19	24	25	30	13	6	38	55
Gradebook programs	18	60	7	4	8	83	75	24	7	8	70	86
Comp. communication	12	21	8	4	12	17	25	37	0	16	23	41
Tools and utilities	50	80	25	21	21	34	61	51	18	53	54	78

Appendix 5

Topics Taught by Computer Education Teachers

Topics taught about in computer education lessons (during school year 1988/1989 and 1991/1992) - Percentage computer using (computer education) teachers checking topics

	JPN		NET		USA
Elementary Schools	89	92	89	92	89
Computer & society	39	35	20	27	27
History/evolution	13	9	9	8	17
Relevance	18	19	10	17	19
Impact of applications	26	14	12	16	14
Ethical issues	12	24	2	4	7
Applications	74	79	47	60	39
Editing/word processing	39	32	21	34	34
Drawing/painting	50	51	11	17	14
Spreadsheets	5	8	0	0	1
Database management	6	12	1	1	4
Statistical applications	2	9	1	0	0
Artificial intelligence	1	0	0	0	0
Authoring languages	17	8	0	2	0
Models and simulations	20	21	2	3	13
Laboratory instrumentation	4	9	0	0	0
Scanning/image processing	13	8	0	0	0
CAD/CAM/process control	0	1	0	0	0
Telecom/networks	6	10	1	2	3
(Educational) games	42	47	35	42	0
Music generation	14	15	0	0	0
Problem analysis & programming	32	14	10	5	21
General concepts, analysis	14	5	3	1	13
General procedures	8	4	0	0	6
Structure of programs	13	4	4	3	10
Programming languages	23	13	4	3	9
Problem analysis	2	1	0	0	3
Principals of hard-/software	31	14	19	13	29
Basic computer concepts	27	14	18	11	27
Hardware, principals	6	3	1	0	9
Software, principals	11	3	0	2	14
Min. Valid N of Cases	84	77	91	93	148
Max. Percent Missing Cases	0	3	5	1	8

Topics taught about in computer education lessons (during school year 1988/1989 and 1991/1992) - Percentage computer using (computer education) teachers checking topics

	AUT		BUL	GRE		JPN		NET		USA
Lower Secondary Schools	89	92	92	89	92	89	92	89	92	89
Computer & society	93	96	84	98	96	40	47	68	78	78
History/evolution	58	66	64	95	91	23	17	39	48	64
Relevance	63	85	77	96	90	16	14	45	62	54
Impact of applications	74	69	50	85	77	22	28	41	49	59
Ethical issues	60	73	20	42	40	27	36	23	32	45
Applications	100	100	87	93	94	81	81	95	100	95
Editing/word processing	91	97	47	78	90	47	49	85	90	82
Drawing/painting	63	79	66	11	19	43	42	32	35	49
Spreadsheets	65	90	11	27	9	11	22	45	61	40
Database management	51	78	9	55	45	7	10	46	71	52
Statistical applications	13	16	3	2	3	10	10	5	7	7
Artificial intelligence	2	3	1	4	6	2	3	2	3	6
Authoring languages	7	7	9	20	18	15	9	4	4	8
Models and simulations	10	33	9	4	11	36	41	20	29	29
Laboratory instrumentation	0	1	3	2	1	15	13	1	0	5
Scanning/image processing	5	15	3	2	3	11	12	1	1	5
CAD/CAM/process control	38	51	4	2	2	2	2	10	11	8
Telecom/networks	6	17	5	2	11	6	2	18	23	16
(Educational) games	79	94	67	18	31	28	33	54	64	66
Music generation	13	13	29	4	15	9	9	4	2	20
Problem analysis & programming	88	89	95	96	91	53	37	56	48	71
General concepts, analysis	56	64	82	65	75	36	14	25	17	57
General procedures	9	43	86	42	56	23	6	4	2	52
Structure of programs	50	72	82	49	66	27	17	23	23	14
Programming languages	72	80	90	95	86	49	33	41	29	59
Problem analysis	32	37	77	71	76	12	4	11	5	33
Principals of hard-/software	85	95	52	93	99	48	44	72	83	72
Basic computer concepts	56	75	40	85	95	47	42	68	80	68
Hardware, principals	61	77	32	67	89	11	7	24	38	48
Software, principals	61	92	26	47	81	20	9	18	26	42
Min. Valid N of Cases	163	255	76	55	220	122	85	188	231	132
Max. Percent Missing Cases	1	4	16	0	12	0	2	1	0	1

Topics taught about in computer education lessons (during school year 1988/1989 and 1991/1992) - Percentage computer using (computer education) teachers checking topics

	AUT	BUL	IND		JPN		LAT	SLO		USA
Upper Secondary Schools	89	92	89	92	89	92	92	89	92	89
Computer & society	83	91	71	77	71	69	79	89	89	71
History/evolution	49	74	52	66	55	50	64	80	74	56
Relevance	52	87	29	54	45	49	52	73	89	47
Impact of applications	68	60	45	60	52	51	63	56	74	54
Ethical issues	50	28	13	26	31	42	34	20	58	48
Applications	85	94	91	93	78	79	99	96	97	86
Editing/word processing	60	57	64	78	48	43	84	76	95	73
Drawing/painting	22	74	37	42	30	34	82	38	39	31
Spreadsheets	39	27	39	49	24	33	69	33	68	54
Database management	57	29	39	51	12	10	64	44	86	52
Statistical applications	11	10	21	20	15	15	24	20	27	11
Artificial intelligence	13	11	5	18	2	3	11	16	16	7
Authoring languages	3	12	10	20	19	1	22	51	63	8
Models and simulations	17	5	14	21	22	17	25	18	11	19
Laboratory instrumentation	1	4	9	23	21	19	15	2	11	4
Scanning/image processing	5	4	3	6	14	4	21	4	11	5
CAD/CAM/process control	15	11	3	3	12	8	7	24	19	7
Telecom/networks	11	12	1	11	12	7	41	9	19	21
(Educational) games	29	57	57	50	19	20	81	47	55	42
Music generation	5	32	36	35	4	6	14	7	14	12
Problem analysis & programming	96	94	83	88	87	78	95	98	87	66
General concepts, analysis	85	90	60	76	80	62	92	84	79	58
General procedures	36	84	42	62	72	52	70	51	71	57
Structure of programs	82	83	59	80	74	60	88	80	74	15
Programming languages	95	89	62	83	84	74	93	93	73	61
Problem analysis	82	82	47	69	70	58	83	87	78	48
Principals of hard-/software	89	65	85	91	83	72	89	91	89	77
Basic computer concepts	61	52	80	85	80	69	80	84	79	75
Hardware, principals	65	50	55	75	47	47	72	84	84	57
Software, principals	76	33	49	72	44	37	58	67	76	48
Min. Valid N of Cases	274	124	458	177	408	108	131	45	37	279
Max. Percent Missing Cases	0	17	0	1	0	4	10	0	3	2

Appendix 6

Item-, Test Statistics, and Opportunity to Learn per Item

For researchers wanting to inspect the full text of the test items, a copy of the test is available, upon request, at:

IEA Headquarters
Sweelinckplein 14
2517 GK The Hague
The Netherlands
Tel: +31 70 34 69 679
Fax: +31 70 36 09 951

KR-20 for total test and item-rest correlations for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
KR-20	.55	.47	.77	.85	.79	.77	.76	.73	.77	.73	.86	.77	.80	.77	.78	.80
Rir item 1	.19	.20	.18	.32	.13	.26	.20	.18	.19	.27	.18	.37	.24	.18	.25	.17
Rir item 2	.20	.16	.21	.36	.28	.24	.31	.17	.17	.33	.32	.30	.26	.26	.23	.21
Rir item 3	.10	.07	.31	.43	.33	.33	.29	.20	.23	.42	.20	.40	.34	.22	.27	.33
Rir item 4	.23	.11	.38	.45	.37	.38	.32	.28	.27	.35	.38	.33	.45	.22	.30	.28
Rir item 5	.20	.13	.36	.38	.49	.23	.24	.36	.34	.45	.37	.30	.34	.26	.31	.39
Rir item 6	.20	.12	.12	.20	.20	.28	.25	.27	.20	.25	.21	.23	.30	.26	.32	.24
Rir item 7	.18	.11	.26	.47	.27	.23	.36	.26	.25	.40	.44	.34	.39	.39	.28	.36
Rir item 8	.19	.16	.26	.33	.30	.28	.29	.22	.30	.27	.35	.23	.31	.20	.27	.35
Rir item 9	.25	.18	.13	.28	.23	.33	.32	.20	.23	.15	.36	.38	.28	.38	.20	.20
Rir item 10	.29	.26	.25	.43	.25	.26	.37	.29	.35	.22	.44	.38	.32	.32	.23	.25
Rir item 11	.17	.15	.31	.46	.36	.42	.14	.30	.30	.36	.48	.39	.31	.39	.39	.37
Rir item 12	.15	.12	.31	.43	.28	.24	.12	.21	.24	.22	.45	.17	.26	.15	.33	.27
Rir item 13	.22	.21	.34	.24	.38	.21	.28	.32	.29	.32	.34	.22	.31	.26	.34	.31
Rir item 14	.18	.17	.29	.32	.33	.28	.18	.30	.33	.30	.42	.26	.24	.29	.29	.34

Notes: Elementary Schools: KR-20 and Rir items 1 to 17 based on first 17 items; Secondary Schools: KR-20 and Rir excluded items 17, 18 and 23 because of translation errors.

KR-20 and item-rest correlations for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Rir item 15	.15	.18	.25	.37	.34	.14	.25	.24	.27	.05	.40	.24	.28	.24	.31	.29
Rir item 16	.15	.17	.10	.18	.16	.0	.18	.15	.27	.02	.19	.08	.22	.10	.20	.19
Rir item 17	.14	.01	.37	.21	.30	.32	-	.25	.14	.32	.25	.23	-	.39	.37	.22
*Rir item 18	.15	-	.31	.32	.20	.17	-	.27	.33	.28	.34	.08	-	.28	.21	.40
*Rir item 19	.13	-	.37	.34	.35	.33	.36	.25	.33	.21	.46	.31	.43	.34	.36	.43
*Rir item 20	.26	-	.28	.40	.34	.24	.13	.31	.32	.21	.47	.24	.25	.35	.40	.36
*Rir item 21	.20	-	.25	.39	.34	.34	.35	.26	.32	.31	.41	.24	.38	.29	.21	.37
*Rir item 22	.30	-	.43	.39	.42	.41	.39	.37	.43	.31	.35	.35	.41	.38	.37	.50
*Rir item 23	.20	-	.26	.24	.24	.29	-	.23	.21	.27	.30	.25	-	.20	.27	.33
*Rir item 24	.30	-	.39	.44	.37	.43	.33	.41	.40	.21	.51	.33	.38	.37	.37	.40
*Rir item 25	.27	-	.34	.38	.19	.36	.23	.35	.36	.16	.39	.32	.24	.31	.29	.33
*Rir item 26	.13	-	.28	.45	.27	.36	.29	.12	.17	.21	.42	.30	.27	.30	.24	.22
*Rir item 27	.14	-	.33	.50	.34	.28	.34	.13	.31	.24	.49	.31	.38	.40	.34	.37
*Rir item 28	.35	-	.42	.36	.37	.45	.27	.40	.45	.26	.51	.28	.36	.32	.39	.46
*Rir item 29	.18	-	.30	.47	.25	.22	.23	.15	.15	.25	.47	.16	.23	.23	.30	.27
*Rir item 30	.22	-	.41	.51	.38	.36	.40	.32	.44	.19	.58	.37	.44	.43	.41	.51

Notes: * = international option for elementary schools, - = information not available.
Elementary Schools: Rir items 1 to 17 based on first 17 items, Rir items 18 to 30 based on 30 items; Secondary Schools: Rir excluded items 17, 18 and 23 because of translation errors, Rir items 17, 18 and 23 based on 30 items.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 1:																
Concepts																
Rir	.19	.20	.18	.32	.13	.26	.20	.18	.19	.27	.18	.37	.24	.18	.25	.17
Dialling a telephone number																
!A.input	50	43	72	68	90	63	67	69	60	82	76	36	78	88	85	72
B.processing	18	32	7	6	3	15	5	8	16	4	4	35	5	2	6	11
C.output	15	14	5	13	1	3	14	12	18	3	5	18	9	1	2	13
D.none	5	11	12	12	5	17	9	9	6	8	14	6	7	8	6	3
no answer	1	1	4	2	1	2	5	1	0	3	1	5	1	1	1	0
Correct answer																
girls	48	40	70	67	89	61	62	69	62	78	74	32	72	87	82	69
boys	52	45	74	67	92	64	72	70	59	86	79	36	82	89	90	75
no computer use	M	M	M	57	M	M	65	M	M	M	M	32	71	M	83	M
use only outside	49	M	M	M	M	M	69	63	M	M	M	42	75	M	M	M
use only at school	M	M	69	M	M	61	70	69	59	77	75	67	80	89	84	70
at school&outside	52	44	75	M	92	64	69	72	61	85	M	78	87	90	87	73
OTL	17	10	81	34	67	86	11	66	20	95	70	-	43	92	-	15

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 2:																
Concepts																
Rir	.20	.16	.21	.36	.28	.24	.31	.17	.17	.33	.32	.30	.26	.26	.23	.21
Sorting books																
in new order																
A.input	16	22	9	20	2	8	12	8	10	4	12	17	4	3	12	6
!B.processing	54	49	70	43	82	75	64	71	68	84	64	42	88	90	67	77
C.output	10	8	4	19	4	4	8	5	3	2	10	23	3	1	2	1
D.none	17	20	13	15	10	12	11	14	19	7	12	10	4	5	16	15
no answer	3	1	4	3	2	2	5	1	0	3	1	9	1	1	3	0
Correct answer																
girls	52	48	67	40	79	74	59	69	67	79	63	39	85	89	64	74
boys	56	49	72	46	85	76	69	74	70	89	66	42	90	91	70	81
no computer use	M	M	M	33	M	M	65	M	M	M	M	39	84	M	65	M
use only outside	49	M	M	M	M	M	62	74	M	M	M	51	90	M	M	M
use only at school	M	M	67	M	M	72	64	68	64	79	64	59	88	90	64	72
at school&outside	58	49	73	M	85	78	65	72	69	88	M	75	91	93	68	79
OTL	27	9	84	34	63	87	8	65	24	97	65	-	41	91	-	18

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 3:																
Concepts																
Rir	.10	.07	.31	.43	.33	.33	.29	.20	.23	.42	.20	.40	.34	.22	.27	.33
BASIC, PASCAL																
and LOGO																
A.word processing	24	25	14	4	16	10	17	28	30	5	2	15	14	1	2	22
B.math. programs	13	15	8	9	3	4	6	10	12	1	2	27	6	2	2	8
C.operating syst.	25	35	16	8	17	9	31	21	27	7	2	19	19	3	3	23
!D.progr.langu.	34	24	58	73	62	77	31	38	31	85	94	30	57	93	92	46
no answer	4	1	4	6	3	1	15	3	1	3	0	9	4	1	1	0
Correct answer																
girls	32	25	51	71	60	75	27	34	28	75	94	28	55	90	90	42
boys	35	23	66	75	63	80	34	42	34	95	94	32	60	97	96	52
no computer use	M	M	M	63	M	M	26	M	M	M	M	25	48	M	90	M
use only outside	33	M	M	M	M	M	35	40	M	M	M	44	58	M	M	M
use only at school	M	M	51	M	M	75	32	33	25	77	94	74	57	93	91	37
at school&outside	35	23	63	M	65	79	34	40	33	91	M	80	72	96	94	49
OTL	6	13	88	43	74	89	10	53	29	96	76	-	41	90	-	15

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 4:																
Concepts																
Rir	.23	.11	.38	.45	.37	.38	.32	.28	.27	.35	.38	.33	.45	.22	.30	.28
Physical parts of a computer																
A.programs	16	13	7	16	12	8	10	11	5	1	7	11	5	4	1	2
B.manuals	21	18	10	29	6	33	26	8	19	2	24	26	19	4	2	20
C.software	15	38	19	15	22	11	28	16	28	5	11	30	21	2	18	19
!D.hardware	45	30	62	31	56	46	28	64	47	89	55	27	53	89	78	58
no answer	2	1	2	9	4	2	9	1	0	3	2	7	2	1	1	0
Correct answer																
girls	43	29	59	30	50	40	19	63	46	85	56	27	45	88	76	54
boys	48	32	66	33	62	51	36	66	48	93	53	27	60	91	82	62
no computer use	M	M	M	24	M	M	24	M	M	M	M	24	42	M	71	M
use only outside	45	M	M	M	M	M	30	69	M	M	M	33	62	M	M	M
use only at school	M	M	58	M	M	41	29	60	45	86	54	53	51	87	79	56
at school&outside	49	30	66	M	61	49	33	65	48	92	M	65	66	94	82	59
OTL	21	35	95	33	82	94	14	82	41	100	73	-	40	90	-	21

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 5:																
Concepts																
Rir	.20	.13	.36	.38	.49	.23	.24	.36	.34	.45	.37	.30	.34	.26	.31	.39
Create your own software																
!A.write programs	29	12	55	52	64	51	33	50	29	83	74	25	58	89	56	47
B.TYPE or LIST	26	21	9	10	5	10	27	21	15	2	5	27	16	4	5	10
C.copy oper. syst.	33	43	17	22	11	18	22	23	38	7	14	19	15	3	17	27
D.cannot produce	9	23	13	9	15	17	7	5	18	4	5	20	7	3	16	16
no answer	3	1	5	7	5	4	11	2	1	4	2	10	4	1	5	0
Correct answer																
girls	28	11	46	52	55	50	28	43	27	74	72	26	47	88	50	42
boys	30	12	65	52	73	53	37	57	31	92	78	24	66	89	65	53
no computer use	M	M	M	44	M	M	26	M	M	M	M	22	47	M	43	M
use only outside	27	M	M	M	M	M	41	52	M	M	M	32	63	M	M	M
use only at school	M	M	48	M	M	45	34	40	18	76	74	48	57	90	54	34
at school&outside	31	12	61	M	71	55	38	53	32	89	M	59	71	90	65	51
OTL	10	12	89	38	69	88	14	56	24	97	74	-	36	90	-	13

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 6:																
Concepts																
Rir	.20	.12	.12	.20	.20	.28	.25	.27	.20	.25	.21	.23	.30	.26	.32	.24
Designed for entering instructions																
A.plotter	17	19	9	17	14	6	21	17	22	8	19	14	21	12	3	15
!B.mouse	45	27	54	22	44	39	40	49	36	67	27	14	54	48	55	49
C.printer	14	19	4	18	3	10	15	6	7	1	22	31	9	21	19	4
D.word processor	24	34	30	32	35	42	15	28	34	20	28	32	14	16	21	32
no answer	1	1	3	11	3	2	9	1	1	4	3	9	3	3	2	1
Correct answer																
girls	41	24	54	22	40	34	33	42	34	61	25	10	44	42	46	46
boys	48	29	54	23	49	46	47	57	39	73	32	15	61	55	67	52
no computer use	M	M	M	15	M	M	31	M	M	M	M	13	46	M	43	M
use only outside	40	M	M	M	M	M	43	54	M	M	M	16	59	M	M	M
use only at school	M	M	56	M	M	36	48	42	32	63	26	22	49	49	52	41
at school&outside	50	27	54	M	45	41	52	51	38	72	M	35	66	58	62	51
OTL	30	26	89	11	68	82	18	51	29	99	41	-	36	82	-	18

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 7:																
Concepts																
Rir	.18	.11	.26	.47	.27	.23	.36	.26	.25	.40	.44	.34	.39	.39	.28	.36
Computer program, definition																
A.computer course	14	25	9	7	3	10	28	8	14	1	3	30	13	8	1	7
!B.instr. to control	48	30	52	65	44	59	44	75	54	84	82	38	73	84	92	71
C.slideshow	19	17	6	11	28	13	16	9	8	1	5	17	8	5	2	4
D.comp. hardware	18	28	32	13	22	17	5	7	23	11	8	10	3	2	4	17
no answer	1	1	3	4	3	2	7	0	1	3	1	5	2	1	1	0
Correct answer																
girls	46	28	46	65	40	55	35	75	50	77	80	37	66	81	91	66
boys	49	33	57	65	49	63	53	76	57	91	87	39	80	87	92	77
no computer use	M	M	M	50	M	M	41	M	M	M	M	34	66	M	87	M
use only outside	46	M	M	M	M	M	52	74	M	M	M	49	80	M	M	M
use only at school	M	M	47	M	M	55	43	69	53	77	82	68	73	85	92	66
at school&outside	49	31	55	M	46	62	44	79	55	89	M	77	81	86	93	73
OTL	26	29	94	44	85	93	14	77	37	99	74	-	38	91	-	21

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 8:																
Concepts																
Rir	.19	.16	.26	.33	.30	.28	.29	.22	.30	.27	.35	.23	.31	.20	.27	.35
Reaction to story friend																
A.pr. never be built	6	4	3	3	11	2	3	3	2	1	1	5	2	1	2	1
B.perhaps in future	31	38	21	33	17	26	34	17	19	7	25	29	23	14	16	9
C.in construction	14	21	10	16	15	16	13	10	15	4	10	20	10	9	7	10
!D.already exists	48	37	63	45	55	54	49	69	63	85	62	42	63	75	71	80
no answer	1	1	2	2	2	1	3	0	1	3	1	4	1	1	3	0
Correct answer																
girls	42	34	57	38	43	48	42	64	60	81	57	38	52	72	68	77
boys	55	40	70	54	66	62	55	74	68	89	70	43	72	79	77	83
no computer use	M	M	M	39	M	M	44	M	M	M	M	41	58	M	62	M
use only outside	51	M	M	M	M	M	59	73	M	M	M	48	74	M	M	M
use only at school	M	M	57	M	M	49	44	64	59	79	58	49	57	75	66	71
at school&outside	52	36	68	M	60	59	52	71	65	88	M	55	71	81	78	82
OTL	14	20	67	21	50	72	15	46	25	78	43	-	31	81	-	17

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items., Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 9:																
Concepts																
Rir	.25	.18	.13	.28	.23	.33	.32	.20	.23	.15	.36	.38	.28	.38	.20	.20
Data stored after updating file																
A.on screen	6	6	1	5	1	2	4	1	2	0	2	13	2	1	1	1
!B.on disk	55	57	85	59	84	55	73	80	74	88	67	28	84	69	77	81
C.working memory	33	31	13	26	12	40	14	17	23	11	22	38	11	27	20	17
D.in printer	5	5	0	6	1	2	4	1	2	0	8	15	2	1	1	1
no answer	1	0	0	4	1	1	4	0	0	0	1	5	1	1	1	0
Correct answer																
girls	50	54	84	55	83	48	70	77	72	84	64	24	85	59	75	80
boys	61	61	87	63	86	64	75	83	76	92	72	31	83	80	81	82
no computer use	M	M	M	52	M	M	69	M	M	M	M	25	80	M	72	M
use only outside	54	M	M	M	M	M	76	82	M	M	M	41	87	M	M	M
use only at school	M	M	85	M	M	51	76	73	73	82	66	55	84	69	74	79
at school&outside	60	58	87	M	88	59	75	82	74	92	M	62	88	81	81	82
OTL	24	26	92	25	67	93	18	79	36	100	50	-	40	88	-	21

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 10:																
Concepts																
Rir	.29	.26	.25	.43	.25	.26	.37	.29	.35	.22	.44	.38	.32	.32	.23	.25
Program, stored permanently																
A.monitor (screen)	5	10	1	9	1	2	3	1	3	0	2	28	1	1	0	2
B.keyboard	3	4	1	5	1	1	5	1	2	0	7	17	1	1	1	1
C.disk drive	13	24	7	14	3	3	10	7	13	2	8	16	5	3	2	10
!D.disk or diskette	79	62	91	71	95	93	79	91	82	98	82	34	92	95	95	88
no answer	1	0	0	1	0	1	3	0	0	0	1	6	1	1	0	0
Correct answer																
girls	77	62	88	69	94	94	77	89	84	97	80	34	92	94	95	89
boys	82	62	93	73	95	93	81	93	80	99	86	32	91	96	97	86
no computer use	M	M	M	61	M	M	76	M	M	M	M	29	88	M	94	M
use only outside	79	M	M	M	M	M	83	93	M	M	M	51	94	M	M	M
use only at school	M	M	89	M	M	94	77	86	77	97	81	67	92	95	96	87
at school&outside	83	63	92	M	97	93	84	93	84	98	M	80	95	97	95	88
OTL	28	34	95	36	74	95	14	82	41	100	62	-	44	88	-	23

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 11: Concepts																
Rir	.17	.15	.31	.46	.36	.42	.14	.30	.30	.36	.48	.39	.31	.39	.39	.37
Program after turning off computer																
A.lost from disk	22	30	16	8	13	30	33	18	28	7	7	17	28	8	10	21
!B.remains on disk	38	27	61	59	70	47	28	56	42	81	73	24	51	76	66	59
C.in memory	17	17	13	19	6	14	14	11	11	8	10	22	10	9	12	8
D.returns on screen	22	26	10	12	11	9	22	15	18	2	9	31	11	6	10	11
no answer	1	0	1	2	1	1	3	0	1	1	1	5	1	1	2	0
Correct answer																
girls	35	25	54	52	62	38	24	47	38	68	71	20	44	68	55	52
boys	42	30	68	68	77	57	31	65	47	94	78	25	56	85	82	68
no computer use	M	M	M	47	M	M	24	M	M	M	M	21	40	M	60	M
use only outside	36	M	M	M	M	M	33	59	M	M	M	31	59	M	M	M
use only at school	M	M	54	M	M	39	24	45	37	70	72	45	48	77	56	48
at school&outside	43	28	66	M	76	52	38	60	44	89	M	58	64	86	73	63
OTL	19	31	97	18	73	95	12	76	38	100	59	-	42	86	-	24

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 12: Concepts Rir	.15	.12	.31	.43	.28	.24	.12	.21	.24	.22	.45	.17	.26	.15	.33	.27
Device, gives text you can read																
A.floppy disk-drive	16	14	9	32	11	10	23	13	11	2	23	17	20	14	5	8
B.hard disk-drive	13	11	13	9	6	7	18	10	7	5	6	15	20	5	3	4
!C.printer	52	51	71	44	61	69	25	60	61	90	60	47	36	59	80	70
D.modem	17	23	5	9	14	10	24	17	20	2	8	13	19	18	8	18
no answer	2	1	2	5	7	3	10	1	1	1	3	8	5	4	5	0
Correct answer																
girls	50	50	65	39	54	67	22	54	59	86	56	46	31	57	74	65
boys	55	53	77	50	69	72	28	65	63	94	69	47	41	61	87	76
no computer use	M	M	M	36	M	M	23	M	M	M	M	46	29	M	77	M
use only outside	52	M	M	M	M	M	26	62	M	M	M	51	37	M	M	M
use only at school	M	M	66	M	M	66	27	57	58	89	57	51	35	59	76	68
at school&outside	54	52	75	M	64	72	24	61	63	92	M	61	48	61	84	72
OTL	29	25	95	24	64	89	17	83	34	100	49	-	39	84	-	22

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 13:																
Computer handling																
Rir	.22	.21	.34	.24	.38	.21	.28	.32	.29	.32	.34	.22	.31	.26	.34	.31
Reason for making a back-up copy																
A.use diff. oper.sys	16	11	7	16	10	11	18	8	5	3	14	23	17	11	32	4
B.necess. to print	11	9	5	10	5	10	16	6	6	1	11	25	10	5	4	4
!C.may go wrong	64	72	71	46	66	49	54	80	81	89	47	28	64	58	56	83
D.not necessary	7	7	13	21	15	26	5	5	8	7	25	13	6	24	3	8
no answer	3	0	3	7	3	3	7	1	0	1	3	10	2	2	5	0
Correct answer																
girls	62	74	68	46	60	48	49	79	82	82	47	27	59	55	47	84
boys	65	71	76	46	72	51	58	80	80	94	49	28	69	61	69	83
no computer use	M	M	M	37	M	M	51	M	M	M	M	28	57	M	50	M
use only outside	62	M	M	M	M	M	59	83	M	M	M	31	72	M	M	M
use only at school	M	M	65	M	M	48	52	72	77	83	46	28	60	55	46	78
at school&outside	67	74	76	M	71	50	54	82	83	93	M	37	75	66	64	85
OTL	11	18	80	17	53	84	10	40	26	98	38	-	33	78	-	23

Notes: ! = correct alternative, - = information not available, M = number of cases <500. Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 14:																
Computer handling																
Rir	.18	.17	.29	.32	.33	.28	.18	.30	.33	.30	.42	.26	.24	.29	.29	.34
Number of keys to get help																
A.1	22	18	26	19	16	11	5	16	15	15	12	22	4	13	15	13
!B.2	45	39	57	41	60	61	53	68	59	73	43	37	63	56	69	71
C.3	14	13	12	14	12	21	34	11	9	11	14	19	28	17	11	9
D.6	17	30	3	20	10	4	5	5	17	1	28	13	4	11	3	7
no answer	1	1	2	7	2	2	3	1	0	0	4	9	1	3	2	0
Correct answer																
girls	44	39	50	41	55	59	54	64	57	60	40	35	62	55	66	70
boys	46	39	63	41	65	65	53	72	60	86	48	37	65	57	73	72
no computer use	M	M	M	35	M	M	50	M	M	M	M	35	59	M	55	M
use only outside	45	M	M	M	M	M	54	64	M	M	M	41	68	M	M	M
use only at school	M	M	48	M	M	57	56	62	50	60	42	49	62	54	68	62
at school&outside	49	40	62	M	68	65	57	73	62	83	M	62	69	62	78	73
OTL	18	31	93	26	74	92	14	74	31	99	55	-	36	71	-	21

Notes: ! = correct alternative; - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 15.																
Computer handling																
Rir	.15	.18	.25	.37	.34	.14	.25	.24	.27	.05	.40	.24	.28	.24	.31	.29
Different word processing programs																
A.one laser printer	11	9	4	7	3	7	5	5	6	2	9	18	4	5	5	4
B.one port. comp.	5	10	2	8	7	4	18	3	5	1	6	16	15	5	6	4
C.different speed	18	13	8	9	6	14	9	11	12	4	9	18	7	5	7	8
!D.diff. oper. syst.	64	68	85	69	83	73	60	80	76	92	73	40	71	82	77	84
no answer	2	0	2	7	2	2	7	1	0	1	3	9	3	2	6	0
Correct answer																
girls	66	72	86	73	83	78	60	83	80	94	74	41	72	80	74	86
boys	62	63	84	65	83	68	61	77	71	91	72	40	70	85	82	82
no computer use	M	M	M	66	M	M	56	M	M	M	M	37	69	M	73	M
use only outside	64	M	M	M	M	M	65	82	M	M	M	48	75	M	M	M
use only at school	M	M	82	M	M	76	62	76	71	93	74	66	66	83	74	83
at school&outside	66	68	86	M	86	71	63	81	77	92	M	66	75	86	82	85
OTL	8	8	60	12	35	58	4	26	17	83	21	-	23	73	-	15

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 16:																
Computer handling																
Rir	.15	.17	.10	.18	.16	.0	.18	.15	.27	.02	.19	.08	.22	.10	.20	.19
Copy-protected disk																
A.has writeprot. tab	8	12	26	28	23	41	13	13	11	34	42	24	16	20	13	11
!B.cannot copied	38	43	43	20	43	22	20	49	61	51	25	15	34	45	35	68
C.has protect. coat	22	20	22	28	15	18	27	17	10	12	17	23	21	13	22	7
D.prot. while copy	30	25	7	18	16	18	29	21	18	2	14	32	26	19	23	13
no answer	2	0	2	6	3	1	10	1	0	0	2	7	4	2	6	0
Correct answer																
girls	33	40	46	19	35	22	16	48	57	53	23	11	25	40	32	68
boys	43	46	40	21	50	22	24	49	64	49	29	16	40	51	40	68
no computer use	M	M	M	21	M	M	18	M	M	M	M	13	30	M	35	M
use only outside	40	M	M	M	M	M	23	51	M	M	M	25	39	M	M	M
use only at school	M	M	44	M	M	23	19	46	59	52	25	21	30	43	33	62
at school&outside	39	44	42	M	43	21	24	49	62	50	M	32	40	45	35	70
OTL	10	15	79	14	44	82	9	27	17	89	38	-	26	71	-	17

Notes: ! = correct alternative, - = information not available, M = number of cases <500. Elementary Schools: Item-rest correlation based on first 17 items. Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test .

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 17:																
Computer handling																
Rir	.14	.01	.37	.21	.30	.32	-	.25	.14	.32	.25	.23	-	.39	.37	.22
First program to load after re-start																
A.word processor	18	22	16	9	20	17	-	16	26	8	13	12	-	13	8	22
!B.operating syst.	30	34	56	16	51	49	-	47	39	84	28	25	-	41	39	48
C.error detector	34	28	17	53	15	14	-	21	20	4	40	39	-	23	31	14
D.progr. language	16	16	9	15	10	17	-	15	14	3	16	17	-	21	17	15
no answer	2	1	2	7	4	2	-	1	1	0	4	8	-	2	6	1
Correct answer																
girls	28	34	49	14	45	40	-	44	37	75	24	20	-	36	32	45
boys	32	33	63	19	57	60	-	49	41	93	37	26	-	47	48	52
no computer use	M	M	M	15	M	M	-	M	M	M	M	24	-	M	28	M
use only outside	31	M	M	M	M	M	-	49	M	M	M	22	-	M	M	M
use only at school	M	M	48	M	M	42	-	40	35	77	24	30	-	38	29	40
at school&outside	32	33	61	M	62	56	-	49	40	91	M	46	-	56	49	50
OTL	6	14	85	12	48	86	-	47	21	97	25	-	-	69	-	15

Notes: ! = correct alternative, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on first 17 items, Secondary Schools: Item-rest correlation based on 30 items.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 18:																
Applications																
Rir	.15	-	.31	.32	.20	.17	-	.27	.33	.28	.34	.08	-	.28	.21	.40
Fixing misplaced sentence																
A.search & replace	12	-	5	11	4	22	-	10	25	4	13	24	-	22	36	17
!B.move/cut&paste	15	-	52	42	44	41	-	31	41	77	47	24	-	54	29	58
C.insert	24	-	26	18	34	15	-	35	11	15	27	17	-	13	21	13
D.delete & retype	49	-	16	23	17	20	-	23	23	4	10	25	-	9	12	12
no answer	1	-	1	6	1	2	-	0	0	0	2	10	-	2	2	0
Correct answer																
girls	14	-	48	42	44	40	-	28	38	72	47	21	-	52	23	54
boys	15	-	55	41	44	42	-	34	43	82	47	25	-	57	37	62
no computer use	M	-	M	37	M	M	-	M	M	M	M	24	-	M	29	M
use only outside	11	-	M	M	M	M	-	34	M	M	M	25	-	M	M	M
use only at school	M	-	47	M	M	39	-	26	30	68	48	20	-	52	21	45
at school&outside	17	-	56	M	45	43	-	33	44	83	M	33	-	65	31	61
OTL	7	-	93	13	43	80	-	57	25	85	26	-	-	81	-	18

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation based on 30 items.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 19: Applications																
Rir	.13	-	.37	.34	.35	.33	.36	.25	.33	.21	.46	.31	.43	.34	.36	.43
Software for keeping track of budget																
A.word processor	16	-	8	15	10	10	9	15	12	4	16	24	5	5	3	9
B.progr. language	10	-	4	12	4	8	6	6	8	1	8	16	5	4	3	5
!C.spreadsheet pr.	54	-	83	53	77	73	65	72	61	94	62	34	79	85	87	77
D.telecomm. pr.	18	-	3	13	6	7	14	7	19	0	11	19	8	5	5	9
no answer	2	-	2	7	3	2	6	1	0	0	3	8	2	1	2	1
Correct answer																
girls	52	-	82	53	74	69	64	70	62	92	62	36	81	82	86	75
boys	56	-	84	53	80	77	66	74	60	97	64	32	79	88	88	78
no computer use	M	-	M	49	M	M	59	M	M	M	M	32	76	M	81	M
use only outside	57	-	M	M	M	M	70	75	M	M	M	43	87	M	M	M
use only at school	M	-	80	M	M	71	69	67	55	93	63	50	75	85	88	71
at school&outside	54	-	85	M	84	75	68	73	64	96	M	63	85	89	90	79
OTL	3	-	92	10	28	64	8	49	20	93	25	-	22	77	-	19

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 20:																
Applications																
Rir	.26	-	.28	.40	.34	.24	.13	.31	.32	.21	.47	.24	.25	.35	.40	.36
Use of computer in computer network																
!A.use files togeth.	62	-	71	44	76	55	26	84	63	88	53	37	39	75	79	77
B.access other sch.	12	-	12	12	8	23	12	6	15	5	14	13	12	9	6	11
C.send sch. mess.	14	-	10	14	8	13	30	6	15	4	16	22	30	6	6	8
D.send stud. mess.	10	-	4	21	5	7	26	3	7	1	14	19	16	8	4	3
no answer	3	-	3	9	2	2	6	1	0	1	3	9	3	2	5	1
Correct answer																
girls	62	-	73	42	77	51	23	84	65	85	50	36	33	69	77	77
boys	62	-	69	45	75	59	29	84	61	91	58	37	44	82	82	76
no computer use	M	-	M	42	M	M	23	M	M	M	M	35	34	M	74	M
use only outside	62	-	M	M	M	M	25	86	M	M	M	38	43	M	M	M
use only at school	M	-	70	M	M	52	30	81	60	87	53	58	36	76	78	70
at school&outside	65	-	73	M	80	57	31	85	65	90	M	64	46	83	83	79
OTL	5	-	50	13	19	49	17	48	13	74	22	-	21	77	-	11

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 21: Applications																
Rir	.20	-	.25	.39	.34	.34	.35	.26	.32	.31	.41	.24	.38	.29	.21	.37
Start writing a new story																
A.load document	14	-	15	12	8	12	14	12	20	11	14	19	11	14	54	16
B.save document	13	-	15	8	6	12	8	8	15	6	7	18	7	7	7	12
!C.enter text	61	-	66	63	84	69	69	76	55	83	67	35	79	70	30	66
D.print document	10	-	3	8	1	6	4	3	10	0	9	21	2	7	5	4
no answer	1	-	2	8	1	1	6	1	0	1	3	8	1	2	4	1
Correct answer																
girls	61	-	64	65	82	67	67	75	55	76	67	33	80	67	24	67
boys	62	-	68	61	85	70	71	77	55	89	68	34	78	74	38	66
no computer use	M	-	M	54	M	M	64	M	M	M	M	33	76	M	33	M
use only outside	62	-	M	M	M	M	74	79	M	M	M	37	84	M	M	M
use only at school	M	-	61	M	M	66	72	72	49	78	67	46	75	69	22	60
at school&outside	64	-	69	M	87	70	73	78	58	88	M	59	85	78	31	69
OTL	10	-	95	11	49	86	15	62	30	88	22	-	26	80	-	20

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 22:																
Applications																
Rir	.30	-	.43	.39	.42	.41	.39	.37	.43	.31	.35	.35	.41	.38	.37	.50
Working on same story, the next day																
!A.load document	47	-	72	40	80	63	48	68	58	92	48	23	70	56	41	72
B.save document	19	-	8	18	7	10	21	15	14	2	15	20	13	12	15	9
C.enter text	24	-	15	21	7	17	14	13	20	5	14	26	11	14	29	14
D.print document	9	-	4	12	5	8	10	4	7	1	19	20	5	17	11	4
no answer	1	-	1	9	1	2	8	1	0	1	4	11	2	2	5	1
Correct answer																
girls	43	-	65	37	75	58	44	63	56	87	43	23	67	47	32	71
boys	52	-	79	42	85	69	51	72	60	97	57	24	72	66	53	74
no computer use	M	-	M	32	M	M	41	M	M	M	M	21	60	M	30	M
use only outside	48	-	M	M	M	M	54	71	M	M	M	27	77	M	M	M
use only at school	M	-	63	M	M	58	51	60	46	89	47	43	67	52	33	62
at school&outside	51	-	78	M	86	68	51	71	62	96	M	57	81	71	49	76
OTL	9	-	95	13	54	87	17	63	33	91	22	-	29	79	-	21

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 23: Applications																
Rir	.20	-	.26	.24	.24	.29	-	.23	.21	.27	.30	.25	-	.20	.27	.33
Software for writing letters																
!A.word processor	36	-	62	51	59	27	-	47	39	80	56	24	-	44	48	54
B.database progr.	25	-	15	15	10	18	-	18	13	6	10	18	-	20	18	11
C.spreadsheet pr.	4	-	4	6	3	6	-	2	9	1	5	15	-	3	7	6
D.telecomm. pr.	33	-	17	20	24	46	-	34	38	13	25	35	-	30	24	28
no answer	2	-	2	8	3	3	-	1	0	1	4	8	-	3	4	1
Correct answer																
girls	36	-	61	48	56	22	-	44	39	75	55	19	-	42	41	48
boys	35	-	64	55	62	32	-	50	40	86	59	26	-	47	57	61
no computer use	M	-	M	46	M	M	-	M	M	M	M	24	-	M	40	M
use only outside	32	-	M	M	M	M	-	47	M	M	M	24	-	M	M	M
use only at school	M	-	59	M	M	24	-	39	37	76	54	29	-	44	43	49
at school&outside	40	-	66	M	63	30	-	50	40	86	M	33	-	50	55	56
OTL	11	-	86	9	54	80	-	56	29	88	25	-	-	75	-	20

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Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 24:																
Applications																
Rir	.30	-	.39	.44	.37	.43	.33	.41	.40	.21	.51	.33	.38	.37	.37	.40
Cell to enter information in																
A. D17	9	-	9	15	8	10	12	5	9	3	19	18	11	7	9	6
B. B10	18	-	8	13	9	13	7	9	11	2	11	24	6	5	5	6
C. F10	15	-	8	9	9	24	9	9	7	1	8	19	7	5	4	4
!D. D10	55	-	72	51	71	48	65	76	72	92	56	24	73	81	79	84
no answer	3	-	3	12	4	5	6	1	1	1	5	14	3	3	4	1
Correct answer																
girls	54	-	74	52	72	47	64	77	75	91	55	25	74	79	78	87
boys	55	-	72	49	69	48	67	75	70	94	57	25	73	83	80	81
no computer use	M	-	M	43	M	M	61	M	M	M	M	21	68	M	72	M
use only outside	53	-	M	M	M	M	70	80	M	M	M	32	81	M	M	M
use only at school	M	-	70	M	M	44	68	70	67	91	55	55	68	82	77	80
at school&outside	59	-	75	M	74	51	67	78	75	95	M	59	79	85	84	87
OTL	14	-	90	12	28	34	10	45	11	89	27	-	20	76	-	14

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 25: Applications																
Rir	.27	-	.34	.38	.19	.36	.23	.35	.36	.16	.39	.32	.24	.31	.29	.33
Sorted newspaper-file																
!A.account number	57	-	82	55	68	70	74	81	83	96	71	40	81	90	89	91
B.name	18	-	6	18	5	16	9	9	9	0	11	18	5	3	4	4
C.house number	10	-	3	12	19	4	5	3	4	0	7	16	2	1	2	2
D.subscription date	13	-	7	7	4	8	9	6	4	3	9	15	10	5	4	2
no answer	2	-	2	8	3	3	3	1	1	1	3	11	2	2	2	1
Correct answer																
girls	58	-	85	56	69	71	75	83	86	94	70	41	80	89	89	94
boys	55	-	80	55	68	68	73	79	80	97	72	40	82	90	88	87
no computer use	M	-	M	46	M	M	71	M	M	M	M	37	77	M	86	M
use only outside	54	-	M	M	M	M	75	86	M	M	M	50	83	M	M	M
use only at school	M	-	80	M	M	68	76	75	79	95	71	59	82	90	88	89
at school&outside	61	-	84	M	70	72	76	83	85	96	M	64	85	94	92	92
OTL	13	-	84	8	24	57	10	49	14	91	28	-	26	78	-	14

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 26:																
Concepts																
Rir	.13	-	.28	.45	.27	.36	.29	.12	.17	.21	.42	.30	.27	.30	.24	.22
Electronically saved information																
!A.saving on a disk	47	-	85	60	83	53	55	58	67	94	68	31	71	71	68	71
B.in memory	40	-	10	16	12	27	21	33	25	5	16	27	17	26	22	25
C.in machine langua.	6	-	2	7	1	10	8	5	4	0	5	21	5	0	4	2
D.sending to printer	5	-	2	9	2	7	8	3	3	0	8	13	5	2	3	1
no answer	2	-	2	8	1	3	9	1	1	0	3	9	2	1	3	1
Correct answer																
girls	47	-	84	57	83	50	53	58	71	93	68	28	73	66	67	74
boys	47	-	85	63	85	58	56	58	64	95	69	33	69	77	69	67
no computer use	M	-	M	50	M	M	50	M	M	M	M	29	68	M	63	M
use only outside	48	-	M	M	M	M	61	57	M	M	M	35	74	M	M	M
use only at school	M	-	83	M	M	52	55	51	65	92	68	49	69	70	65	72
at school&outside	46	-	86	M	86	56	59	61	69	96	M	62	75	80	73	71
OTL	18	-	96	27	51	92	10	65	39	99	59	-	35	89	-	22

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 27:																
Concepts																
Rir	.14	-	.33	.50	.34	.28	.34	.13	.31	.24	.49	.31	.38	.40	.34	.37
Loading data from storage																
A.modem	30	-	9	8	14	21	13	34	20	7	16	14	11	7	21	16
!B.disk drive	40	-	77	61	79	52	43	51	62	90	64	30	67	73	56	75
C.printer	12	-	3	10	2	10	16	4	6	0	10	19	8	11	10	3
D.monitor	15	-	7	11	3	12	18	9	11	2	6	25	10	6	4	5
no answer	2	-	3	11	2	4	10	1	1	1	4	12	3	2	9	1
Correct answer																
girls	38	-	72	58	74	48	35	47	59	84	62	27	59	65	46	73
boys	43	-	83	64	84	57	50	55	65	97	69	31	74	83	69	77
no computer use	M	-	M	51	M	M	36	M	M	M	M	28	53	M	50	M
use only outside	36	-	M	M	M	M	48	50	M	M	M	35	73	M	M	M
use only at school	M	-	71	M	M	47	45	46	53	86	63	43	70	69	47	68
at school&outside	46	-	82	M	83	57	54	54	65	94	M	56	82	87	62	77
OTL	12	-	95	20	56	83	12	50	37	99	60	-	36	87	-	23

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 28:																
Computer handling																
Rir	.35	-	.42	.36	.37	.45	.27	.40	.45	.26	.51	.28	.36	.32	.39	.46
Reason for use																
identification number																
!A.prevent to order	65	-	76	48	56	56	48	81	68	94	59	30	59	66	77	82
B.assigned to ticket	10	-	6	9	12	13	13	7	13	1	13	23	13	7	4	7
C.match flight code	13	-	11	15	19	18	26	7	14	4	13	20	21	20	10	7
D.show how use	10	-	4	16	7	10	4	4	4	1	11	15	4	5	5	2
no answer	2	-	3	12	6	4	8	1	1	1	5	12	3	2	4	1
Correct answer																
girls	64	-	74	47	54	54	45	82	71	92	57	28	52	59	74	83
boys	66	-	78	51	59	57	51	80	65	97	62	32	64	75	83	82
no computer use	M	-	M	44	M	M	46	M	M	M	M	29	53	M	73	M
use only outside	65	-	M	M	M	M	50	88	M	M	M	35	66	M	M	M
use only at school	M	-	69	M	M	52	51	73	60	91	58	41	57	63	74	72
at school&outside	69	-	80	M	60	59	49	83	72	97	M	52	65	76	82	86
OTL	12	-	64	3	33	45	2	43	17	90	25	-	23	67	-	12

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 29:																
Computer handling																
Rir	.18	-	.30	.47	.25	.22	.23	.15	.15	.25	.47	.16	.23	.23	.30	.27
Print data, switch is set to off-line																
A.every other line	12	-	21	9	11	10	14	8	13	12	9	14	10	11	9	11
!B.not printed	49	-	52	57	53	62	40	54	52	78	62	33	57	64	55	62
C.printed diagonal	9	-	6	6	5	7	5	8	11	2	6	15	4	4	6	6
D.on same line	26	-	15	13	25	17	29	27	22	6	16	24	25	15	21	19
no answer	3	-	6	15	5	4	12	3	1	2	7	13	5	5	8	2
Correct answer																
girls	48	-	49	55	44	61	37	53	51	73	60	31	58	59	47	61
boys	50	-	54	59	61	63	43	54	54	84	65	33	56	70	67	64
no computer use	M	-	M	43	M	M	34	M	M	M	M	32	50	M	50	M
use only outside	53	-	M	M	M	M	44	56	M	M	M	31	53	M	M	M
use only at school	M	-	48	M	M	62	42	47	51	73	60	42	60	62	47	54
at school&outside	50	-	55	M	57	63	47	56	53	85	M	45	66	71	62	65
OTL	9	-	72	8	36	67	6	26	19	95	26	-	33	66	-	15

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available. M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Item-rest correlations, percentage per answer alternative, percentage correct for groups of students and percentage Opportunity to Learn (OTL) for FIT-test

	Elementary		Lower Secondary							Upper Secondary						
	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 30:																
Computer handling																
Rir	.22	-	.41	.51	.38	.36	.40	.32	.44	.19	.58	.37	.44	.43	.41	.51
Function of cursor																
A.help message	16	-	4	14	4	8	8	8	8	0	14	24	5	6	3	3
B.points datastorage	18	-	8	11	5	7	16	9	10	1	11	21	10	4	6	5
C.shows brightness	18	-	3	12	4	7	14	7	5	0	8	18	6	2	5	3
!D.marks place	43	-	81	49	84	75	52	74	76	98	59	23	75	86	81	87
no answer	4	-	4	15	3	3	11	2	1	1	8	14	3	2	4	1
Correct answer																
girls	41	-	79	49	85	75	37	73	79	96	57	24	72	82	79	89
boys	44	-	84	49	85	75	65	75	73	99	62	24	78	91	84	85
no computer use	M	-	M	39	M	M	45	M	M	M	M	19	63	M	72	M
use only outside	42	-	M	M	M	M	62	73	M	M	M	30	80	M	M	M
use only at school	M	-	77	M	M	73	51	69	72	97	58	57	78	87	83	81
at school&outside	46	-	85	M	91	78	55	77	78	99	M	72	87	94	86	90
OTL	28	-	98	34	74	98	22	81	40	100	78	-	42	91	-	22

Notes: ! = correct alternative, * = international option for elementary schools, - = information not available, M = number of cases <500, Elementary Schools: Item-rest correlation based on 30 items, Secondary Schools: Item-rest correlation excluded items 17, 18 and 23.

Appendix 7

Student Attitude Items, and Percentage Agreement

KR-21 and item-rest correlations for students attitude scales

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Relevance																	
KR-21	.66	.59	-	.56	.67	.67	.68	.71	.60	.65	.50	.61	.73	.65	.58	.64	.65
Rir item 3	.33	.23	-	.25	.29	.36	.30	.34	.20	.37	.26	.24	.35	.29	.19	.35	.39
*Rir item 4	.29	.13	-	.23	.46	.29	.40	.42	.16	.32	.20	.34	.59	.34	.31	.40	.39
*Rir item 5	.34	.41	-	.31	.41	.36	.41	.42	.41	.43	.32	.43	.40	.39	.36	.42	.45
Rir item 7	.46	.28	-	.36	.47	.47	.45	.52	.36	.46	.34	.36	.59	.43	.35	.42	.44
*Rir item 8	.36	.27	-	.27	.40	.46	.40	.44	.28	.37	.26	.35	.41	.39	.28	.33	.38
*Rir item 10	.40	.42	-	.31	.35	.33	.39	.42	.40	.32	.21	.29	.37	.39	.36	.38	.30
Rir item 11	.38	.41	-	.31	.37	.43	.40	.44	.42	.38	.27	.36	.40	.38	.38	.30	.37
Enjoyment																	
KR-21	.67	.68	.59	.85	.77	.85	.81	.82	.84	.79	.89	.78	.74	.86	.81	.85	.83
Rir item 1	.38	.51	.40	.63	.57	.61	.55	.51	.64	.52	.70	.58	.50	.58	.56	.70	.57
Rir item 9	.44	.25	.22	.37	.29	.41	.27	.50	.37	.37	.47	.27	.28	.59	.15	.33	.41
*Rir item 12	.49	.59	-	.56	.60	.59	.61	.55	.60	.50	.64	.57	.44	.61	.61	.68	.58
*Rir item 13	.44	.49	-	.55	.32	.55	.40	.51	.54	.51	.66	.39	.42	.59	.43	.54	.55
Rir item 14	.52	.35	.35	.54	.51	.52	.56	.66	.44	.54	.62	.56	.56	.72	.59	.65	.61
*Rir item 15	.55	.63	-	.63	.53	.66	.65	.61	.67	.50	.68	.60	.43	.65	.56	.57	.51
Rir item 16	.39	.44	.37	.61	.58	.65	.61	.52	.59	.53	.69	.56	.41	.58	.64	.67	.55
Rir item 17	.29	.45	.23	.57	.31	.58	.41	.43	.60	.34	.69	.31	.41	.46	.50	.55	.43
Rir item 18	.41	.46	.39	.59	.37	.60	.39	.46	.56	.48	.64	.31	.32	.54	.56	.46	.53
Parental Support																	
KR-21	.54	.61	-	.64	.66	.63	.56	.65	.63	.74	.63	.70	.58	.69	.51	.67	.73
Rir item 2	.37	.45	-	.48	.49	.46	.39	.49	.46	.59	.46	.54	.40	.53	.34	.51	.57
*Rir item 6	.37	.45	-	.48	.49	.46	.39	.49	.46	.59	.46	.54	.40	.53	.34	.51	.57

Notes: * = international option for elementary schools; - = information not available; Elementary Schools: KR-21 enjoyment based on non-optional items, Rir non-optional items enjoyment based on 6 items, Rir international options based on 9 items.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 1: Enjoyment																	
Rir	.38	.51	.40	.63	.57	.61	.55	.51	.64	.52	.70	.58	.50	.58	.56	.70	.57
Talk to others about computers																	
strong disagree	41	15	29	25	27	34	16	45	24	33	36	23	7	40	28	17	27
slight disagree	26	31	28	35	14	24	20	29	37	30	34	22	7	34	21	21	30
slight agree	12	41	31	24	18	27	42	15	30	29	20	23	28	16	32	29	32
strong agree	6	13	10	16	39	13	20	7	8	7	11	30	56	6	16	11	7
no opinion/ no answer	15	1	2	0	2	2	1	3	1	2	0	3	3	3	3	22	4
Positive answer																	
girls	16	37	41	19	47	17	55	13	18	30	10	45	86	15	33	31	33
boys	19	71	42	61	69	63	71	30	57	41	50	67	83	29	65	53	46
no computer use	10	M	M	M	50	M	M	14	M	M	M	M	83	12	M	18	M
use outside	19	58	M	M	M	M	M	32	36	M	M	M	83	35	M	M	M
use at school	20	M	M	21	M	M	54	18	25	26	5	48	90	15	46	32	32
school&outs.	35	55	42	51	M	50	69	35	44	38	47	M	89	40	69	54	41

Notes: M = number of cases <500, SLO: no opinion/no answer includes a special category neutral, Elementary schools: Item-rest correlation based on non-optional items.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 2:																	
Parental support																	
Rir	.37	.45	-	.48	.49	.46	.39	.49	.46	.59	.46	.54	.40	.53	.34	.51	.57
Parents encourage working with comp.																	
strong disagree	41	42	32	42	47	41	25	40	29	19	38	39	11	31	58	38	13
slight disagree	16	38	21	32	13	26	22	27	40	17	34	15	8	27	14	13	17
slight agree	9	14	25	19	15	20	31	15	23	35	21	18	27	22	16	22	38
strong agree	6	4	19	7	23	11	20	9	6	28	6	26	48	12	10	7	28
no opinion/ no answer	28	2	2	1	3	2	2	8	2	2	0	2	5	7	2	19	3
Positive answer																	
girls	16	14	45	23	33	27	47	26	23	63	27	38	76	39	22	28	68
boys	14	24	44	28	44	34	55	23	35	62	28	53	76	31	31	32	66
no computer use	7	M	M	M	31	M	M	17	M	M	M	M	74	26	M	18	M
use outside	17	21	M	M	M	M	M	34	34	M	M	M	84	45	M	M	M
use at school	20	M	M	19	M	M	43	21	19	48	19	40	88	29	27	20	53
school&outs.	33	20	47	30	M	36	57	37	32	67	33	M	91	45	29	41	71

Notes: - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 3: Relevance																	
Rir	.33	.23	-	.25	.29	.36	.30	.34	.20	.37	.26	.24	.35	.29	.19	.35	.39
Computers help to learn more easily																	
strong disagree	25	7	7	17	21	19	11	28	13	6	21	29	9	27	23	12	5
slight disagree	19	16	9	23	10	18	14	30	28	11	27	15	8	35	14	9	13
slight agree	25	48	28	37	17	38	37	25	44	42	34	23	25	26	36	32	43
strong agree	9	28	55	22	46	23	36	11	14	40	17	29	53	8	22	20	37
no opinion/ no answer	23	1	1	1	5	2	2	6	2	1	1	3	5	5	5	28	1
Positive answer																	
girls	33	74	84	54	60	54	71	34	52	82	46	48	79	30	53	51	80
boys	34	79	82	65	69	68	76	38	62	81	57	59	77	36	63	53	82
no computer use	27	M	M	M	63	M	M	30	M	M	M	M	77	31	M	40	M
use outside	34	75	M	M	M	M	M	40	53	M	M	M	79	38	M	M	M
use at school	36	M	M	55	M	M	72	39	54	80	45	50	87	27	57	46	78
school&outs.	51	77	84	63	M	63	75	45	61	82	57	M	87	41	69	62	82

Notes: - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 4:																	
Relevance																	
Rir	.29	.13	-	.23	.46	.29	.40	.42	.16	.32	.20	.34	.59	.34	.31	.40	.39
Possible to do many practical things																	
strong disagree	11	3	-	7	5	12	4	9	3	4	5	4	7	6	3	5	3
slight disagree	15	5	-	12	5	12	7	12	6	7	9	3	10	8	6	6	4
slight agree	29	45	-	36	12	37	25	33	50	30	37	13	27	32	28	33	27
strong agree	30	45	-	43	76	37	63	41	40	59	49	79	49	52	60	44	65
no opinion/ no answer	15	2	-	1	2	2	2	5	1	1	0	1	7	2	2	13	1
Positive answer																	
girls	60	89	-	77	87	72	86	72	90	90	80	92	79	86	88	76	93
boys	59	92	-	81	91	76	89	75	91	87	91	91	75	83	90	77	92
no computer use	53	M	-	M	88	M	M	69	M	M	M	M	76	80	M	65	M
use outside	65	91	-	M	M	M	M	80	93	M	M	M	73	91	M	M	M
use at school	56	M	-	77	M	M	87	73	85	87	80	91	79	81	89	77	91
school&outs.	67	91	-	81	M	77	88	78	92	90	90	M	84	87	91	82	93

Notes: * = international option for elementary schools, - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 5: Relevance																	
Rir	.34	.41	-	.31	.41	.36	.41	.42	.41	.43	.32	.43	.40	.39	.36	.42	.45
Knowing use comp. does well in career																	
strong disagree	8	13	-	10	15	7	9	5	13	4	5	12	6	4	8	5	4
slight disagree	12	34	-	15	7	8	12	6	34	7	8	10	6	4	9	4	5
slight agree	35	37	-	31	18	29	31	25	37	24	32	18	23	21	34	31	27
strong agree	41	14	-	43	56	53	47	63	13	65	55	58	59	71	47	48	63
no opinion/ no answer	4	2	-	1	5	2	2	1	3	1	0	2	6	1	2	12	1
Positive answer																	
girls	78	45	-	73	73	81	76	90	48	89	82	75	82	95	77	79	89
boys	75	58	-	76	74	83	80	85	51	87	91	79	81	90	84	79	90
no computer use	76	M	-	M	71	M	M	84	M	M	M	M	81	90	M	65	M
use outside	78	51	-	M	M	M	M	91	51	M	M	M	80	97	M	M	M
use at school	69	M	-	68	M	M	74	90	48	83	81	73	87	87	80	80	87
school&outs.	79	50	-	78	M	87	81	91	51	90	93	M	91	94	89	86	91

Notes: * = international option for elementary schools, - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary							
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 6:																		
Parental support																		
Rir	.37	.45	-	.48	.49	.46	.39	.49	.46	.59	.46	.54	.40	.53	.34	.51	.57
Parents want me to be good on computer																		
strong disagree	39	28	-	23	32	26	15	32	26	11	19	27	8	18	18	19	8
slight disagree	20	43	-	31	13	23	21	28	45	16	28	14	8	24	13	8	16
slight agree	11	20	-	31	18	31	38	21	21	36	38	20	25	28	32	27	39
strong agree	6	6	-	14	31	17	23	13	5	35	14	36	52	24	33	19	35
no opinion/ no answer	24	3	-	1	6	3	2	6	4	2	0	3	6	6	4	27	3
Positive answer																		
girls	18	21	-	40	45	45	60	37	21	71	47	53	77	58	59	43	73
boys	15	31	-	50	55	50	63	32	31	70	58	62	77	48	71	51	74
no computer use	11	M	-	M	43	M	M	27	M	M	M	M	76	44	M	35	M
use outside	19	27	-	M	M	M	M	42	26	M	M	M	80	61	M	M	M
use at school	16	M	-	36	M	M	57	33	22	63	43	54	87	48	64	37	63
school&outs.	30	26	-	51	M	54	66	46	28	73	62	M	91	63	76	57	76

Notes: * = international option for elementary schools, - = information not available, M = number of cases <500. SLO: no opinion/no answer includes a special category neutral.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 7:																	
Relevance																	
Rir	.46	.28	-	.36	.47	.47	.45	.52	.36	.46	.34	.36	.59	.43	.35	.42	.44
Knowing use computer is a worthwhile skill																	
strong disagree	22	2	7	4	6	5	5	11	3	4	2	3	1	5	1	1	2
slight disagree	28	8	10	9	4	8	7	19	6	6	3	2	18	11	3	1	3
slight agree	29	51	30	35	12	38	27	38	56	30	34	11	77	35	18	23	23
strong agree	17	38	53	51	75	47	60	31	34	59	61	83	3	47	77	71	71
no opinion/ no answer	5	1	1	1	4	2	2	1	1	1	0	1	2	2	1	4	1
Positive answer																	
girls	43	87	84	85	85	83	87	65	88	91	93	93	81	85	95	94	95
boys	48	92	82	88	90	88	87	72	91	88	96	95	80	79	96	93	94
no computer use	41	M	M	M	83	M	M	61	M	M	M	M	80	78	M	88	M
use outside	47	90	M	M	M	M	M	75	91	M	M	M	77	88	M	M	M
use at school	43	M	M	83	M	M	86	73	88	87	91	94	82	78	95	95	93
school&outs.	61	90	84	89	M	90	88	75	91	91	97	M	85	86	96	96	95

Notes: - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 8: Relevance																	
Rir	.36	.27	-	.27	.40	.46	.40	.44	.28	.37	.26	.35	.41	.39	.28	.33	.38
Opportunity to learn about computers																	
strong disagree	41	7	-	2	8	7	4	25	5	3	2	4	6	20	2	2	2
slight disagree	26	19	-	3	5	9	5	34	15	5	4	4	5	34	2	2	3
slight agree	17	47	-	19	11	32	15	26	56	22	23	13	14	30	19	20	20
strong agree	10	25	-	75	75	51	76	15	22	70	71	77	70	16	76	72	76
no opinion/ no answer	6	2	-	1	2	1	1	1	1	1	0	1	5	1	1	5	1
Positive answer																	
girls	26	69	-	94	87	82	92	38	76	94	94	91	86	47	95	93	96
boys	27	76	-	95	84	85	89	43	80	90	95	89	83	44	95	90	95
no computer use	21	M	-	M	81	M	M	33	M	M	M	M	83	41	M	87	M
use outside	29	68	-	M	M	M	M	41	76	M	M	M	82	49	M	M	M
use at school	29	M	-	94	M	M	90	44	75	91	93	90	88	44	95	93	94
school&outs.	37	76	-	96	M	86	91	58	80	93	96	M	90	52	95	94	96

Notes: * = international option for elementary schools, - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 9: Enjoyment																	
Rir	.44	.25	.22	.37	.29	.41	.27	.50	.37	.37	.47	.27	.28	.59	.15	.33	.41
Computers can be exciting																	
strong disagree	27	9	4	8	11	18	6	26	12	6	15	9	10	21	19	5	5
slight disagree	19	17	5	19	7	14	10	25	24	8	25	9	11	28	19	5	8
slight agree	20	41	21	32	22	33	30	24	40	35	32	23	28	30	38	37	39
strong agree	22	32	69	40	58	33	52	22	22	51	28	58	43	19	20	38	47
no opinion/ no answer	12	2	1	1	3	2	2	2	2	0	0	2	8	2	5	15	1
Positive answer																	
girls	42	65	91	64	79	53	81	44	51	86	52	80	74	49	55	74	84
boys	41	81	89	80	80	78	83	49	73	85	69	83	69	50	61	77	88
no computer use	30	M	M	M	76	M	M	35	M	M	M	M	70	41	M	68	M
use outside	45	72	M	M	M	M	M	52	64	M	M	M	75	62	M	M	M
use at school	45	M	M	66	M	M	81	55	53	84	48	81	80	43	57	75	82
school&outs.	67	74	91	76	M	69	83	62	66	87	69	M	87	60	59	79	87

Notes: M = number of cases <500, SLO: no opinion/no answer includes a special category neutral, Elementary schools: Item-rest correlation based on non-optional items.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 10: Relevance																	
Rir	.40	.42	-	.31	.35	.33	.39	.42	.40	.32	.21	.29	.37	.39	.36	.38	.30
Learn about computers to be informed																	
strong disagree	25	4	-	10	10	15	8	27	7	18	18	11	7	24	5	2	14
slight disagree	34	17	-	24	10	21	15	37	19	27	30	12	9	36	9	4	27
slight agree	26	50	-	38	23	39	38	25	54	39	34	25	25	27	39	42	42
strong agree	10	27	-	27	53	23	38	10	19	14	18	49	52	11	45	39	16
no opinion/ no answer	6	2	-	1	4	2	2	1	2	1	0	2	7	2	2	13	1
Positive answer																	
girls	33	72	-	61	76	56	75	30	68	52	54	75	79	36	81	83	58
boys	38	82	-	68	77	68	75	40	78	54	51	72	76	38	87	79	59
no computer use	31	M	-	M	75	M	M	29	M	M	M	M	78	33	M	76	M
use outside	39	79	-	M	M	M	M	39	73	M	M	M	70	39	M	M	M
use at school	36	M	-	62	M	M	75	37	71	47	50	73	76	35	85	81	50
school&outs.	41	77	-	67	M	64	76	44	75	55	54	M	75	46	85	84	60

Notes: * = international option for elementary schools, - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 11: Relevance																	
Rir	.38	.41	-	.31	.37	.43	.40	.44	.42	.38	.27	.36	.40	.38	.38	.30	.37
Comp. skills helps for better jobs																	
strong disagree	11	10	7	4	12	8	8	11	12	3	1	11	5	9	6	7	2
slight disagree	19	32	11	10	9	12	12	17	36	7	5	9	7	14	12	6	7
slight agree	35	44	29	40	18	34	36	38	39	31	43	20	24	39	39	38	35
strong agree	29	12	52	45	56	44	41	33	11	57	51	58	58	37	41	36	56
no opinion/ no answer	5	2	1	1	5	1	2	1	3	1	0	2	6	1	2	14	0
Positive answer																	
girls	64	50	81	86	72	77	78	73	49	90	94	78	84	84	78	76	92
boys	65	62	81	85	78	80	77	70	50	87	94	77	81	71	82	73	91
no computer use	62	M	M	M	70	M	M	66	M	M	M	M	81	74	M	68	M
use outside	66	56	M	M	M	M	M	76	49	M	M	M	81	80	M	M	M
use at school	59	M	M	84	M	M	75	72	49	86	93	77	91	75	80	76	90
school&outs.	69	56	82	87	M	81	80	77	51	89	96	M	87	80	84	76	92

Notes: - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 12: Enjoyment																	
Rir	.49	.59	-	.56	.60	.59	.61	.55	.60	.50	.64	.57	.44	.61	.61	.68	.58
Like reading about comp.																	
strong disagree	41	27	-	43	36	48	25	46	35	44	51	34	6	44	37	29	38
slight disagree	25	35	-	30	14	23	24	34	40	31	27	20	8	35	22	16	34
slight agree	13	26	-	16	21	15	31	11	18	18	14	20	29	14	23	21	22
strong agree	6	11	-	10	24	13	19	5	6	5	8	24	50	6	14	7	5
no opinion/ no answer	16	2	-	1	4	2	2	4	1	2	0	2	7	2	4	26	2
Positive answer																	
girls	16	24	-	10	36	9	40	10	11	18	7	37	81	10	22	18	20
boys	22	50	-	41	58	44	60	22	38	30	37	56	79	26	54	42	36
no computer use	11	M	-	M	43	M	M	10	M	M	M	M	79	10	M	15	M
use outside	23	40	-	M	M	M	M	26	25	M	M	M	76	28	M	M	M
use at school	17	M	-	14	M	M	41	13	17	19	5	39	87	12	33	18	21
school&outs.	34	37	-	32	M	34	56	27	28	25	34	M	88	35	59	39	28

Notes: * = international option for elementary schools, - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral, Elementary schools: Item-rest correlation based on all enjoyment items.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 13: Enjoyment																	
Rir	.44	.49	-	.55	.32	.55	.40	.51	.54	.51	.66	.39	.42	.59	.43	.54	.55
Job using comp. very interesting																	
strong disagree	21	12	-	11	7	23	8	23	17	11	19	10	7	21	7	9	12
slight disagree	28	25	-	22	8	23	13	31	33	17	30	12	8	30	13	11	19
slight agree	26	40	-	36	21	27	36	29	35	43	34	29	27	32	41	39	43
strong agree	21	21	-	29	59	23	41	16	13	28	18	47	51	15	37	22	25
no opinion/ no answer	4	2	-	1	5	3	2	1	2	1	0	3	8	1	2	19	1
Positive answer																	
girls	47	54	-	58	81	41	76	41	40	71	39	76	79	49	71	57	67
boys	48	69	-	74	78	59	78	49	55	70	63	76	77	46	86	66	70
no computer use	40	M	-	M	75	M	M	38	M	M	M	M	77	40	M	44	M
use outside	51	62	-	M	M	M	M	55	47	M	M	M	75	54	M	M	M
use at school	46	M	-	57	M	M	74	43	40	67	38	75	87	41	79	59	65
school&outs.	59	62	-	72	M	56	80	57	52	72	64	M	86	60	88	70	69

Notes: * = international option for elementary schools, - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral. Elementary schools: Item-rest correlation based on all enjoyment items.

Item-rest correlations, students attitude towards computers and positive answer for groups students in percentages

	Elementary			Lower Secondary							Upper Secondary					
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO
Item 14: Enjoyment																
Rir	.52	.35	.35	.54	.51	.52	.56	.66	.44	.54	.62	.56	.56	.72	.59	.65
Comp. lessons favorite subject for me																
strong disagree	31	12	18	15	22	21	25	30	15	25	33	21	7	23	22	37
slight disagree	26	23	16	22	11	17	24	33	27	24	31	17	14	31	21	15
slight agree	19	38	27	32	19	28	30	23	41	28	25	26	25	30	37	19
strong agree	13	24	34	30	39	32	19	12	14	20	10	32	47	14	17	5
no opinion/ no answer	12	3	4	1	9	2	2	2	3	3	0	3	8	2	3	24
Positive answer																
girls	32	59	63	53	51	51	42	28	50	47	24	53	74	43	42	17
boys	32	66	60	73	67	68	56	41	61	49	47	68	71	46	69	33
no computer use	20	M	M	M	52	M	M	25	M	M	M	M	71	31	M	7
use outside	37	61	M	M	M	M	M	44	53	M	M	M	72	58	M	M
use at school	35	M	M	55	M	M	41	35	50	49	21	55	82	39	54	20
school&outs.	59	65	63	70	M	68	55	51	59	49	47	M	83	60	71	35

Notes: M = number of cases <500, SLO: no opinion/no answer includes a special catego neutral, Elementary schools: Item-rest correlation based on non-optional items.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
*Item 15: Enjoyment																	
Rir	.55	.63	-	.63	.53	.66	.65	.61	.67	.50	.68	.60	.43	.65	.56	.57	.51
Want to learn a lot about comp.																	
strong disagree	26	12	-	12	18	18	17	26	16	10	16	19	7	20	14	9	8
slight disagree	28	32	-	24	13	22	21	29	40	17	28	20	6	26	16	10	14
slight agree	24	32	-	34	21	33	33	26	28	38	37	26	19	31	35	37	44
strong agree	17	21	-	29	42	25	27	17	13	34	20	33	61	21	33	24	33
no opinion/ no answer	5	3	-	1	5	2	1	1	2	1	1	2	7	1	2	20	1
Positive answer																	
girls	40	40	-	52	56	44	53	36	27	70	41	54	82	52	57	56	75
boys	41	67	-	74	74	71	70	49	56	73	70	68	79	53	81	68	78
no computer use	34	M	-	M	58	M	M	35	M	M	M	M	79	44	M	43	M
use outside	42	56	-	M	M	M	M	52	43	M	M	M	82	65	M	M	M
use at school	43	M	-	52	M	M	54	41	30	66	39	55	90	46	68	57	68
school&outs.	60	55	-	71	M	62	67	57	46	74	70	M	87	64	82	72	79

Notes: * = international option for elementary schools, - = information not available, M = number of cases <500, SLO: no opinion/no answer includes a special category neutral, Elementary schools: Item-rest correlation based on all enjoyment items.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 16: Enjoyment																	
Rir	.39	.44	.37	.61	.58	.65	.61	.52	.59	.53	.69	.56	.41	.58	.64	.67	.55
Like to scan computer journals																	
strong disagree	52	28	40	37	28	44	27	52	33	47	48	30	8	50	29	32	43
slight disagree	21	42	22	28	14	20	24	30	43	27	27	20	10	31	22	15	28
slight agree	9	19	22	17	21	16	29	10	15	17	14	23	28	12	26	21	20
strong agree	4	9	14	17	32	18	18	5	8	8	12	25	45	6	20	9	7
no opinion/ no answer	13	2	2	1	5	2	2	3	1	2	0	3	9	2	2	23	2
Positive answer																	
girls	11	16	33	13	42	10	36	7	8	17	8	42	72	7	29	17	16
boys	15	40	39	53	67	56	58	23	37	33	42	58	72	25	65	46	38
no computer use	9	M	M	M	50	M	M	10	M	M	M	M	72	8	M	16	M
use outside	14	32	M	M	M	M	M	23	22	M	M	M	69	27	M	M	M
use at school	15	M	M	16	M	M	37	11	14	22	4	43	78	10	42	16	20
school&outs.	23	29	37	43	M	42	55	29	26	25	39	M	76	35	68	42	28

Notes: M = number of cases <500, SLO: no opinion/no answer includes a special category neutral, Elementary schools: Item-rest correlation based on non-optional items.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 17: Enjoyment																	
Rir	.29	.45	.23	.57	.31	.58	.41	.43	.60	.34	.69	.31	.41	.46	.50	.55	.43
Computers interest me little																	
strong disagree	31	35	45	40	42	41	27	34	26	35	31	36	33	36	39	24	34
slight disagree	25	33	19	29	17	20	25	30	35	27	26	21	50	32	22	27	32
slight agree	20	20	19	19	16	20	28	18	24	24	23	19	4	18	21	23	22
strong agree	19	10	15	11	21	17	18	16	13	13	20	21	4	12	15	9	11
no opinion/ no answer	6	3	1	1	4	2	2	2	2	1	0	3	9	2	2	17	2
Positive answer																	
girls	39	39	33	40	40	52	56	38	50	40	60	43	7	30	50	38	36
boys	38	19	36	19	33	23	36	30	25	33	27	34	8	30	21	23	29
no computer use	45	M	M	M	45	M	M	41	M	M	M	M	8	39	M	48	M
use outside	38	27	M	M	M	M	M	28	35	M	M	M	6	19	M	M	M
use at school	29	M	M	41	M	M	55	35	48	43	66	42	5	36	39	37	44
school&outs.	22	26	34	22	M	32	39	22	33	34	26	M	4	19	16	22	30

Notes: M = number of cases <500, SLO: no opinion/no answer includes a special category neutral, Elementary schools: Item-rest correlation based on non-optional items, because of the negative formulation of this item it has been recoded for KR-21 and Item-rest correlations.

Item-rest correlations, students attitude towards computers and positive answer for groups of students in percentages

	Elementary			Lower Secondary							Upper Secondary						
	JPN	NET	USA	AUT	BUL	GER	GRE	JPN	NET	USA	AUT	BUL	IND	JPN	LAT	SLO	USA
Item 18: Enjoyment																	
Rir	.41	.46	.39	.59	.37	.60	.39	.46	.56	.48	.64	.31	.32	.54	.56	.46	.53
Passing a comp. shop, I usually stop																	
strong disagree	48	18	35	18	21	32	16	51	28	36	35	24	12	50	32	18	43
slight disagree	15	29	16	21	9	19	11	24	34	21	23	13	10	25	15	10	24
slight agree	14	32	24	29	19	23	31	13	26	25	26	23	27	15	26	36	21
strong agree	11	20	24	31	45	25	41	10	11	16	16	37	44	7	23	22	11
no opinion/ no answer	11	2	1	1	6	1	1	2	1	1	0	4	6	2	5	15	2
Positive answer																	
girls	25	38	44	42	58	28	66	18	20	33	21	53	69	18	30	49	24
boys	26	66	52	78	73	68	78	28	54	49	61	72	72	26	69	69	41
no computer use	19	M	M	M	60	M	M	16	M	M	M	M	71	12	M	45	M
use outside	31	56	M	M	M	M	M	33	38	M	M	M	66	32	M	M	M
use at school	18	M	M	46	M	M	67	17	27	35	19	56	72	16	46	49	23
school&outs.	37	51	50	70	M	53	77	37	41	43	57	M	71	39	68	65	34

Notes: M = number of cases <500, SLO: no opinion/no answer includes a special category neutral. Elementary schools: Item-rest correlation based on non-optional items.

Appendix 8

Self-Rating Items

Please indicate below what you have learned so far about computers.
For each particular statement, please circle "yes" or "no".

I know . . .

Several advantages of computer use for instruction	yes	no
The difference between a word processor and a desktop publishing program	yes	no
Criteria to judge the quality of a printer	yes	no
The trends in hardware development in the past 20 years	yes	no
What 'file extensions' are	yes	no
What a 'loop' means in programming	yes	no
What a 'relational database' is like	yes	no
What a 'bit' is defined as	yes	no
The difference between 'RAM' and 'ROM'	yes	no

I can write a program for . . .

Adding up numbers	yes	no
Using arrays	yes	no
Storing data on a disk drive	yes	no
Sorting data into a certain sequence	yes	no
Printing the complete ASCII character set	yes	no

I am capable of . . .

Exchanging data between different types of computers	yes	no
Copying files from one disk to another	yes	no
Editing documents with a word processor	yes	no
Loading a data set from a disk drive	yes	no
Creating a database-file	yes	no
Evaluating the usefulness of software for my lessons	yes	no
Adapting instructional software to my needs	yes	no
Writing courseware for my own lessons	yes	no

Appendix 9

Problem List

For each of the following problems, please indicate the seriousness of the problem that you experience in using computers for computer education in the target class. *Please read and respond to each alternative.*

Problem	*Seriousness of problem*		
Hardware			
Insufficient number of computers available	not at all	minor	major
Insufficient number of peripherals (e.g. printer)	not at all	minor	major
Difficulty in keeping computers and peripherals in working order	not at all	minor	major
Limitations of computers (e.g. out-of-date, incompatible with current software, too slow, insufficient memory, etc.)	not at all	minor	major
Software			
Not enough software for instructional purposes available	not at all	minor	major
Software too difficult or too complicated to use	not at all	minor	major
Software not adaptable enough for this class	not at all	minor	major

Problem	*Seriousness of problem*		
Manuals and support materials poorly designed, incomplete or inappropriate	not at all	minor	major
Lack of information about software or its quality	not at all	minor	major
Most of the software is not available in the language of instruction	not at all	minor	major
Instruction			
Not enough help for supervising computer using students	not at all	minor	major
Difficult to integrate computers in my classroom instruction practices	not at all	minor	major
Integration of computer use in the existing prescribed class curriculum is difficult	not at all	minor	major
I lack knowledge / skills about using computers for instructional purposes	not at all	minor	major
Insufficient expertise / guidelines for helping me to use computers instructionally	not at all	minor	major
Organization / administration			
No room in the school time-table for students to learn about or to use computers	not at all	minor	major
Not enough space to locate computers appropriately	not at all	minor	major
Not enough technical assistance for operating and maintaining computers	not at all	minor	major

<u>*Problem*</u>	<u>*Seriousness of problem*</u>		
Problems in scheduling enough computer time for this class	not at all	minor	major
Computers not accessible enough for my own use	not at all	minor	major
Insufficient training opportunities for me	not at all	minor	major
Lack of support or initiatives from the school administration	not at all	minor	major
Inadequate financial support	not at all	minor	major
Miscellaneous			
Not enough time to develop lessons in which computers are used	not at all	minor	major
Lack of interest / willingness of other teachers in using computer	not at all	minor	major
Other *(please specify)* ______________________		minor	major

Appendix 10

Training Topics

For each of the following computer-related topics, indicate whether you learned about it during teacher and/or in-service training?
Please, circle one answer for each topic.

Topic		
Computers and society		
History / evolution	yes	no
Relevance (e.g. for citizen, industry, education)	yes	no
Impact of computer applications (e.g. social, economical)	yes	no
Ethical issues (e.g. copyright, privacy)	yes	no
Applications		
Editing / word processing / desktop publishing	yes	no
Drawing / painting / illustrating	yes	no
Spreadsheets	yes	no
Database management	yes	no
Statistical application programs	yes	no

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Topic

Artificial intelligence / expert systems	yes	no
Authoring languages	yes	no
Models and simulations	yes	no
Laboratory instrumentation	yes	no
Scanning / image processing	yes	no
CAD / CAM / process control / robotics	yes	no
Telecommunications (e.g. electronic mail) / networks	yes	no
Educational games / recreational games	yes	no
Music generation	yes	no

Problem analysis and programming

General concepts (e.g. file, variable, array, loop, etc.)	yes	no
General procedures (e.g. debugging)	yes	no
Structure of programs (e.g. input, output, storage of data flow control)	yes	no
Programming languages (e.g. Basic, Assembler, Pascal, Fortran)	yes	no
Problem analysis (e.g. flowchart, story board, algorithms)	yes	no

<u>*Topic*</u>

Principles of hard-and software structure

Basic concepts about computers and computer systems	yes	no
Hardware (e.g. computer architecture, CPU, data flow control)	yes	no
Software (e.g. software architecture, system software)	yes	no

Pedagogical / instructional aspects

Application of drill / practice / tutorial programs	yes	no
Locate overviews of existing software	yes	no
Evaluation of software	yes	no

Pedagogical / instructional aspects

Integration of software in existing lessons	yes	no
Organization of computer use during lessons	yes	no

Other *(please specify)* ________________________

Appendix 11

Test Grid:

Objectives for the "Core Functional Knowledge Test"

Part A. The computer as part of information technology: What are computers and how do they operate?

A.1 General concepts

The input-processing-output model

A.1.a Show comprehension of the essential functions --relative to input, processing, and output-- of information processing systems.

A.1.b Evaluate at the conceptual level the most likely sources of unsuccessful program operation relative to the "input-processing-output" model of computer operation.

Program-related concepts and vocabulary

A.1.c Distinguish between hardware and software.

A.1.d Be aware that a program directs a computer to carry out certain functions -- related to input, processing, or output-- in logically related steps.

A.1.e. Be aware that programs are written according to the syntax of programming languages, such as, for example, BASIC, Logo, Pascal, and C.

Concepts related to processing

A.1.f Know that processing occurs in a special unit (the CPU) that can be located in a user's own terminal or in a "remote" computer system.

A.1.g Distinguish between information being processed in the active (working) memory of the computer and information saved on storage media.

A.2 Characteristics of components of computer systems

A.2.a Distinguish between a computer (processor or micro processor) and peripherals.

Input devices

A.2.b Identify common input devices for computers such as: keyboard, mouse, optical reader, and sensor.

Output devices

A.2.c Be aware of different categories of the most commonly used output devices, namely printers and monitors.

Storage devices and media

A.2.d Identify some different forms of the most currently popular storage media for microcomputers: diskettes and hard disks.

A.2.e Identify different devices used to read information from commonly available microcomputer storage media: external drives, hard drives.

A.3 System software (operating systems)

A.3.a Identify major functions of operating systems (system software) with respect to program operation and file management.

A.4 Trends with respect to technical developments

A.4.a Be aware of current trends in the technical development of interactive video and other computer-related multimedia.

A.4.b Be aware of current information technology trends such as reductions in size combined with increases in speed, power, and storage capacity.

Part B. Using computers: What are your computer-handling skills?

B.1 Interacting with a computer system

B.1.a Indicating awareness of general strategies for staring up and exiting from a computer system.

B.1.b Indicate awareness of dealing with common access procedures, such as those involving passwords or user identification codes.

B.1.c Indicate awareness of the general functions of the most common special-purpose keys on the computer keyboard: cursor-movement keys, backspace key, shift keys, function keys, control keys, enter (return) and escape keys.

B.1.d Indicate awareness of how to "find one's way" in a program through interacting with menus.

B.1.e Indicate strategies for handling common peripherals such as printers, modems, or a mouse.

B.2 Disk handling and backing up data and software

B.2.a Indicate awareness of the importance of backing up data and of making other sorts of back-up copies of software.

B.2.b Indicate awareness of procedures for backing up data and software.

B.2.c Indicate awareness of strategies for locating files on a disk and for doing common file-handling operations relating to copying, deleting, and renaming files.

B.3 Dealing with common problems

B.3.a Identify common problems that the computer user typically faces such as problems relative to file incompatibility; operating system incompatibility; problems relating to program operation; problems relating to interfacing with peripherals; and problems relating to disk and hardware maintenance.

B.3.b Identify some strategies for dealing with common problems encountered by computer users.

Part C. Applications: What can you do with information technology?

C.1 Common applications of information technology

General categories and examples

C.1.a Identify some categories of activities for which information technology, and computers in general, are often used and some categories for which they, as yet, have little application.

C.1.b Identify some of the applications of microtechnology in the individual's everyday life.

Categories of commonly use software applications

C.1.c Associate selected information processing tasks with the most appropriate category of commonly used software, including word processing; data base management; spreadsheet; telecommunications; software for generating and manipulating graphics, drawing, and other visuals; software for generating and manipulating music and other sounds; software for the capture, display, and manipulation of data from scientific experiments; software for process control and the control of robotics; and software for mathematical calculations.

C.1.d Organize data for entry into categories of commonly used software.

C.1.e Interpret the output from various categories of commonly used software.

Features and functions of common applications software

C.2 Word processing

C.2.a-g Identify and perform the functions of some of the basic features of word processing:

- C.2.a creating a file
- C.2.b retrieving a file
- C.2.c entering text
- C.2.d editing text

C.2.e saving a file
C.2.f formatting text
C.2.g printing text or a file

C.3 Spreadsheets

C.3.a Identify the meaning of some basic vocabulary relative to spreadsheets: row and columns, cells, calculation formulas.

C.3.b-d Make basic decisions relative to the use of spreadsheets and perform the operations in each of the following areas:

C.3.b entering and organizing data
C.3.c determining and entering calculation models for data
C.3.d displaying and interpreting the results of calculations.

C.4 Data bases

C.4.a Know and apply concepts of data bases including file, record, field, search, sort, print.

C.5 Telecommunications as a computer application

C.5.a Be aware of the components necessary for telecommunications applications on a computer: modem, telecommunications software, appropriate connections to other network or computers; and be aware of and use some of the purposes for which telecommunications is commonly applied:

- electronic mail,
- accessing of bulletin boards,
- accessing of on-line data bases and other on-line resources,
- electronic file transfer.

Appendix 12

Coverage of FITT on Content Grid

Part A		Item
A.1.a	Show comprehension of the essential functions --relative to input, processing, and/or output-- of information processing systems	1, 2
A.1.c	Distinguish between hardware and software	4
A.1.d	Be aware that a program directs a computer to carry out certain functions --related to input, processing, and/or output-- in logically related steps	7
A.1.e.	Be aware that programs are written according to the syntax of programming languages, such as, for example, BASIC, Logo, Pascal, and C	3, 5
A.1.g	Distinguish between information being processed in the active (working) memory of the computer and information saved on storage media	9, 11
A.2.b	Identify common input devices for computers such as: keyboard, mouse, optical reader, and sensor	6
A.2.c	Be aware of different categories of the most commonly used output devices, namely printers and monitors	12
A.2.d	Identify some different forms of the most currently popular storage media for microcomputers: diskettes and hard disks	10

Part A		**Item**
A.2.e	Identify different devices used to read information from commonly available microcomputer storage media: external drives, hard drives	27
A.4.b	Be aware of current information technology trends such as reductions in size combined with increases in speed, power, and storage capacity	8

Part B

B.1.b	Indicate awareness of dealing with common access procedures, such as those involving passwords or user identification codes	20, 28
B.1.c	Indicate awareness of the general functions of the most common special-purpose keys on the computer keyboard: cursor-movement keys, backspace key, shift keys, function keys, control keys, enter (return) and escape keys	14, 30
B.1.e	Indicate strategies for handling common peripherals such as printers, modems, or a mouse	29
B.2.a	Indicate awareness of the importance of backing up data and of making other sorts of back-up copies of software	13
B.2.c	Indicate awareness of strategies for locating files on a disk and for doing common file-handling operations relating to copying, deleting, and renaming files	16
B.3.a	Identify common problems that the computer user typically faces such as problems relative to file incompatibility; operating system incompatibility; problems relating to program operation; problems relating to interfacing with peripherals; and problems relating to disk and hardware maintenance	15, 26

B.3.b	Identify some strategies for dealing with common problems encountered by computer users	17

Part C	Item	
C.1.c	Associate an appropriate category of commonly used software	19, 23
C.2.a	Creating a file	21
C.2.b	Retrieving a file	22
C.2.c	Entering text	18
C.3.a	Identify the meaning of some basic vocabulary relative to spreadsheets: row and columns, cells, calculation formulas	24
C.4.a	Know and apply concepts of data bases including file, record, field search, sort, print	25

The Computers in Education study was conducted in elementary, lower and upper secondary schools under the auspices of the International Association for the Evaluation of Educational Achievement.

The first data collection took place in 1989 and the second in 1992. This book contains the first results of the last stage, in which data have been collected in national samples of schools, teachers and students in Austria, Bulgaria, Germany, Greece, India, Japan, Latvia, the Netherlands, Slovenia, and the United States of America.

The study addressed a variety of topics, such as: access to computers by schools and students, software availability, problems experienced by educational practitioners with regard to implementing computers, the way computers are used by schools, teachers, and students, students' knowledge of information technology; gender differences, the way teachers are trained and needs for further training.

Developments over time are reported for countries which participated in the 1989 as well as the 1992 survey.