

ICT AND LOW ACHIEVERS: WHAT DOES PISA TELL US?

Richard Sweet and Alina Meates
Organisation for Economic Cooperation and Development

In

Karpati, A. (Ed.) (2004) *Promoting Equity Through ICT in Education: Projects, Problems, Prospects*,
Budapest, Hungarian Ministry of Education and OECD

1 INTRODUCTION

Nations wishing to raise overall levels of educational achievement are likely to obtain the greatest returns from raising the performance of the lowest achievers: their potential gains are substantially greater than those whose achievement levels are already high. Raising the achievement levels of the lowest achievers is likely to have economic consequences in addition to equity benefits. There are suggestions that raising the performance of low achievers can result in a compressed skill distribution that allows the productivity of the lowest achievers to be raised, and that this in turn is in turn linked to compressed wage distributions (Nickell and Layard, 1998). The widespread dissemination of ICT within schools in recent years, associated with a belief that ICT can be a powerful tool in improving learning outcomes (OECD, 2001a), focuses policy attention on the role that ICT can play in raising the educational performance of the lowest achievers. The extent to which low achieving students have access to ICT both in school and in the home, and the ways that they use ICT, compared to other students, are important issues for policy. They are important because of the important role that ICT skills play in providing access to good jobs in modern economies (Green, Felstead and Gallie, 2000), because of related concerns about the digital divide (OECD, 2000; Wilhelm, 2003), and because of the intriguing possibilities that are hinted at in papers prepared for this workshop (Pelgrum, 2003; Wilhelm, 2003) and in other literature (North Central Regional Educational Laboratory, 1997) that ICT can be used as a tool to improve the learning skills and the motivation to learn of low achieving students.

While the present state of the art of international comparative assessments may not be able to shed a great deal of light on the question of whether or not ICT can be used to help improve the educational performance of low achievers (Pelgrum, 2003), PISA -- the OECD's Programme for International Student Assessment (OECD, 2001b) -- does allow considerable light to be shed on access to ICT by low achievers, both at school and in the home, and upon the ways in which low achievers, compared to other students, use ICT. In addition to gathering data on student achievement in literacy, mathematics and science, the first round of PISA data collection in 2000 included a special student computer familiarity questionnaire. Questions that related to ICT availability and use were also included in the main questionnaire completed by all students and in the school questionnaire completed by school principals.¹ Using data from PISA 2000 on the performance of 15 year-olds, this paper provides an initial report of the relationship between literacy achievement levels and access to and patterns of use of ICT. The data elements from the Student Questionnaire (ST), Computer Familiarity Questionnaire (IT) and School Questionnaire (SC) used in the analysis are shown in Appendix 2.

The analysis focused upon eight questions:

- i. Are low achievers located in schools with lower or higher ratios of students to computers than are other students?
- ii. Do low achievers perceive that they have less access to computers at school than other students?
- iii. Within schools that have few computers, do low achievers seem to gain less access to computers than other students?

1. These three questionnaires are referred to in this paper as the IT Questionnaire (IT), the Student Questionnaire (ST), and the School Questionnaire (SC). Copies of each can be found at <http://www.pisa.oecd.org/docs.htm>.

- iv. Are low achievers likely to be located in schools in which principals report that learning is hindered by a lack of computers for instruction?
- v. Do low achievers have less access to and make less use of computers at home than other students?
- vi. Do low achievers have lower interest in computers than other students?
- vii. Do low achievers report themselves to be less comfortable with and to have less ability in using computers than other students?
- viii. Do low achievers use computers for different purposes than other students?

2 THE ANALYSIS

The goals of educational interventions designed to assist low achievers could be thought of in two ways: to assist students who fail to meet objectively defined performance criteria; or to assist students who perform poorly in relation to other students, whatever their objectively measured performance level. Low achievers can be defined a number of ways. Using PISA data, two of these ways are:

- Those who scored at Level 1 and below on the combined reading literacy scale; and
- Those who fell in the bottom quarter of each country's distribution of performance on the combined reading literacy scale.

The first definition results in widely differing proportions of students from each country being defined as low achievers. Appendix 1 shows that the proportion scoring at Level 1 or below ranged from only six per cent in Korea and seven per cent in Finland to 35% in Luxembourg and 44% in Mexico among OECD countries and 56% in Brazil. In countries where the proportion of low achievers is low, using this definition, the reliability of estimates can be reduced as the result of small sample sizes. On the other hand the second definition, whilst it might result in larger samples and hence more reliable estimates, will include quite low proportions of students in the lowest PISA achievement levels in those countries such as Finland and Korea where the overall level of performance is high and variation around the mean is low. Appendix 1 shows that the proportion of students in each country's lowest quartile scoring at Level 1 or below on the combined reading literacy scale ranges from 100% in Luxembourg, Mexico and Portugal to as few as 23% in Korea and 28% in Finland. Whilst in policy terms, as well as statistically, there are arguments in favour of both definitions, this paper reports only the results for low achievement defined in the first way^{2,3}: in other words it reports data for students who scored at Level 1 or below on the PISA combined reading literacy scale.

2. This is both for reasons of brevity and because those whose performance is objectively the weakest are likely to be the more important priority for remedial attention within individual schools.

3. High achievers are defined here as those scoring at Levels 4 and 5 on the combined reading literacy scale.

3 RESULTS⁴

Are low achievers located in schools with lower or higher ratios of students to computers than are other students?

Table 1 in Appendix 3 shows, for the schools in which students at each achievement level are located, the average number of students per computer by achievement level on the PISA combined literacy scale. Within most OECD countries, the relationship between the availability of computers and achievement level does not appear to be very strong: the number of students per computer in the schools in which the weakest students are located generally does not differ greatly from those in which other students are located.

There are some exceptions however. Among OECD countries, in Mexico and Poland, the Czech Republic and France, and in Brazil among non-OECD countries, there is a significant inverse relationship between achievement level and students per computer, with lower achieving students being found in schools with higher numbers of students per computer. In Mexico, for example, the number of students per computer is around six times as high in the schools where the weakest students are found as in the schools containing the most able students (129 compared to 21). And in France the number of students per computer is around 50% greater in schools where the lowest achievers are located than in the schools where the highest achievers are located (15 compared to 10).

In a number of other countries the reverse trend is apparent. In Denmark, the Netherlands, Germany, Korea, Japan, Italy, Portugal and Russia it is the schools in which the lowest achievers are located that have the fewest students per computer. However the extent of the differences is not as extreme as is the case in countries where the lowest achievers' schools have the least computers. Generally the lowest achievers' schools, in these countries, have around one third more computers than those of the highest achievers. However in Korea the number is nearly double (11 students per computer compared to 6).

Do low achievers perceive that they have less access to computers at school than other students?

Regardless of the actual number of computers in a school, what do low achievers perceive to be their availability? Three questions in the PISA questionnaires allow this to be explored. The ICT questionnaire asked students both how often a computer is available for them to use in the school, and how often they use a computer at school. The student questionnaire asked students a very similar question, with a slightly different wording, about the frequency with which they used a computers at school. Tables 2.1 to 2.3 report the results of these questions, showing the average combined literacy score of those reporting availability or use at each level of frequency.

Whilst the results of the three questions are not completely consistent, some overall conclusions do seem to be justified. First, it is more common for lower achieving students to report that computers are less available to them than it is for them to report that they use them less. In the Czech Republic, Australia, Canada, the United Kingdom, New Zealand, Latvia, Switzerland, the USA and Luxembourg the average literacy scores of those who report that computers are never or infrequently available to them are significantly lower than the scores of those who report that computers are available to them almost every day or a few times a week. On the other hand in Germany the reverse pattern occurs: the lower achievers are more likely to report that computers are frequently available to them at school. When asked about *use* of computers, lower achieving students in Australia, Austria, the Czech Republic and Mexico are more likely to report less frequent use. However, depending upon which question is analysed, the lowest

4. Tables showing the detailed results of the analysis are given in Appendix 3.

achievers in Germany, Sweden, Hungary, Liechtenstein and New Zealand are the more likely to report frequent computer use than are the highest achievers.

In a limited number of countries there is a consistent link between the actual number of computers in a school and their perceived availability to and use by low achievers. In Mexico and the Czech Republic low achievers are likely to be in schools with significantly fewer computers than are high achievers, and they are significantly more likely to report that computers are less available to them and that they use them less frequently. In contrast, low achieving students in Germany are more likely to be found in schools with higher numbers of computers, to report that they are more available to them, and that they use them more often. These patterns of results suggest that in these countries there are strong between school effects governing the relationship between computer availability and use.

On the other hand in a country such as Australia, within school factors are the most likely explanation for the link between ICT access and use and achievement levels. Here, the relationship between the actual number of computers in a school and achievement level is not significant, but within schools the lower achieving students report that computers are both less available to them and that they use them less than do high achieving students.

Within schools that have few computers, do low achievers seem to gain less access to computers than other students?

When computers are plentiful, questions of priority in access are less likely to arise than when they are scarce. And so a key policy question is what happens to low achievers when schools have few computers. In each of the PISA 2000 countries, schools were divided into those with the top quarter, middle half, and bottom quarter ratio of students per computer. Within those schools falling in the bottom quarter (those with the fewest computers, or the most students per computer) students' responses to questions on the availability and use of computers at school were examined in relation to achievement level. The results are reported in Tables 3.1 to 3.3.

Whilst, as with the previous analysis across all schools, the results are not completely consistent across each of three questions, some clear patterns do emerge. First, it is much more common for low achievers who are in schools with few computers to report that they do not have computers available to them very frequently than for high achievers, and it is more common for low achievers to report that they do not have computers available to them for use than for them to report that they do not use them very often.

Second, when computers are scarce, there is a consistent pattern in Hungary, the Czech Republic and Russia for the lowest achievers to report the least frequent availability and use. In Germany, on the other hand, the lowest achievers, within schools with the fewest computers, are the most likely to report that they have computers available to them frequently and that they use them frequently. In Luxembourg, Norway and Sweden the lowest achievers in such schools consistently (in both questions on frequency of computer use) report that they use computers the most frequently.

Are low achievers likely to be located in schools in which principals report that learning is hindered by a lack of computers for instruction?

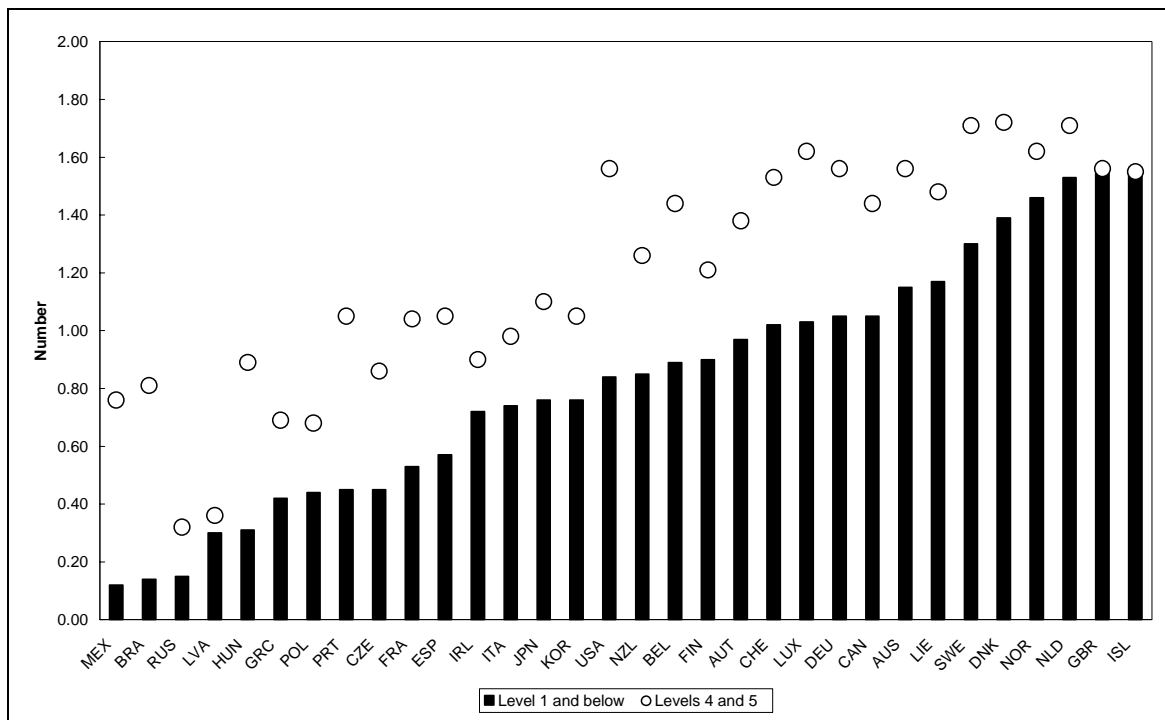
Principals of the schools taking part in PISA 2000 were asked the extent to which learning of 15 year-olds is hindered by a lack of computers. From their responses, a scale was constructed in which "Not at all" = 0, "Very little" = 1, "To some extent" = 2, and "A lot" = 3. Table 4 shows that in Liechtenstein, Mexico, Brazil and France there is a strong tendency for low achievers to be located in schools where principals were most likely to report that a lack of computers hindered instruction. It should be noted that Mexico,

Brazil and France are also among the countries in which low achievers are located in schools that have the fewest computers (Table 1).

Do low achievers have less access to and make less use of computers at home than other students?

The PISA student questionnaire and ICT questionnaire asked five questions about ICT access and use in the home. The relationship between these and achievement on the combined reading literacy scale is shown in Tables 5.1 to 5.5. While the extent of the relationship is stronger for some of these questions than for others, there is a strong overall trend for the ICT resources available in the home to be significantly less for low achievers than for, in particular, high achievers: the number of computers in the homes of low achievers is significantly less than in the homes of high achievers in 25 out of the 31 countries that participated in PISA 2000. In the United States, as an example, the average number of computers in the homes of those scoring at Level 1 or below on the combined reading literacy scale is 0.84, compared to 1.56 in the homes of those scoring at Levels 4 and 5, or roughly half as many. In Hungary, there is an average of 0.31 computers in the homes of the lowest achievers, compared to 0.89 in the homes of the highest achievers, or only around one third as many. Figure 1 shows the number of computers in the homes of the lowest and highest achievers for all PISA 2000 countries

Figure 1: Average number of computers in the homes of the lowest and highest achievers



The relationship between Internet access in the home and achievement level is also very strong, being significant in 22 of the 31 countries. In Finland, as an example, only five per cent of low achievers have an Internet link at home, compared to 55% of the highest achievers. In Switzerland, 13% do so, compared to 39% of high achievers. Similarly, the relationship between achievement level and the availability of educational software in the home is very strong, being significant in 22 of the 32 participating countries. In Korea, as an example, only three per cent of the lowest achievers reported having educational software in the home, compared to 41% of the highest achievers. In France, 10% of low achievers have educational software in the home compared to 39% of the highest achievers.

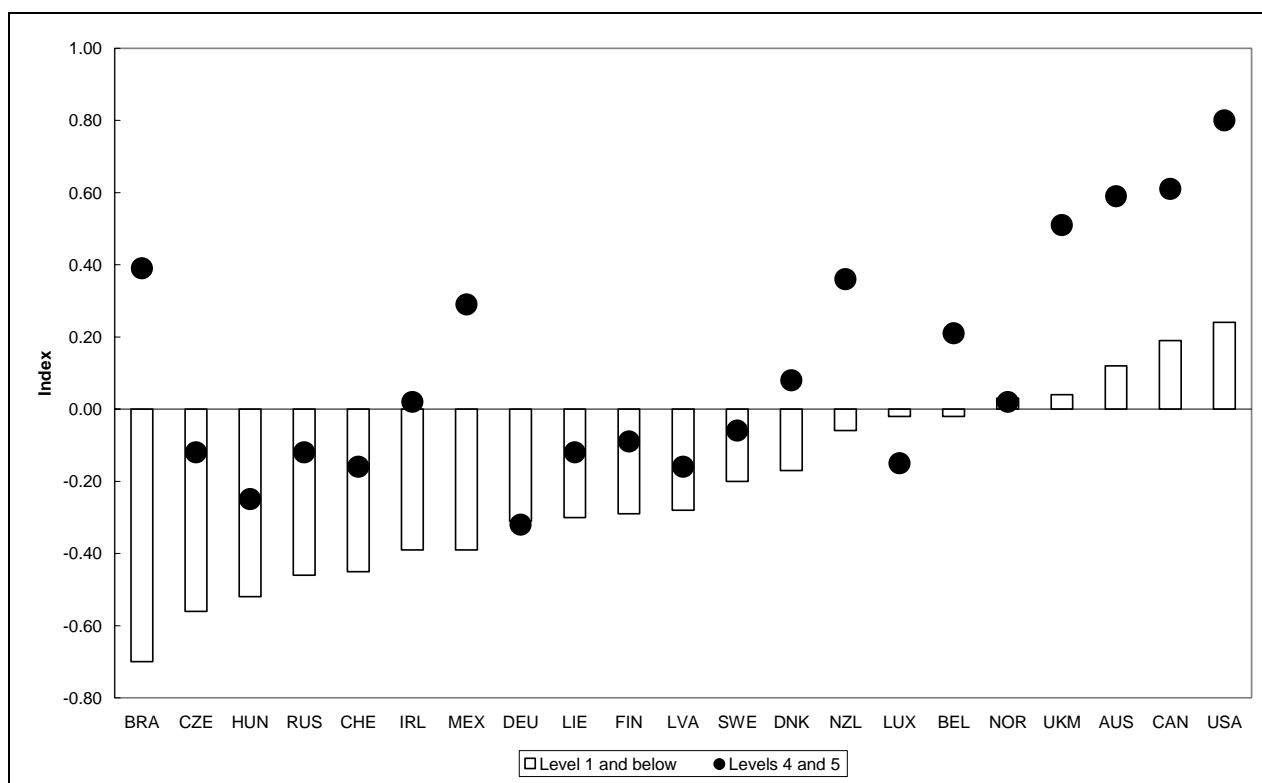
For questions about the availability of computers in the home and about use of computers in the home the relationship with achievement level was not quite as strong, but nevertheless significant in some countries. In Switzerland, Germany, Hungary and the Czech Republic low achievers report that computers are less available to them in the home, and in the United States, Mexico, Australia, Canada, the United Kingdom, Sweden and Russia they report that they use them significantly less in the home than do high achievers.

The very strong relationships observed between achievement level and some indicators of the availability of ICT in the home can be compared to the more modest relationships observed between achievement level and the availability of ICT in the school. Results such as these both emphasise the importance of the school as a source of access to ICT by low achievers, and the importance of schools and school systems addressing ways that low achievers can access and use ICT outside of the classroom and outside of normal school hours.

Do low achievers have lower interest in computers than other students?

Table 6 shows the relationship between the PISA index of interest in computers and achievement level on the combined reading literacy scale. It shows that there are no countries taking part in PISA 2000 in which there is any significant relationship between the two variables. In all OECD countries, low achievers seem to be just as interested in computers as other students.

Figure 2: Index¹ of perceived comfort with and ability to use computers

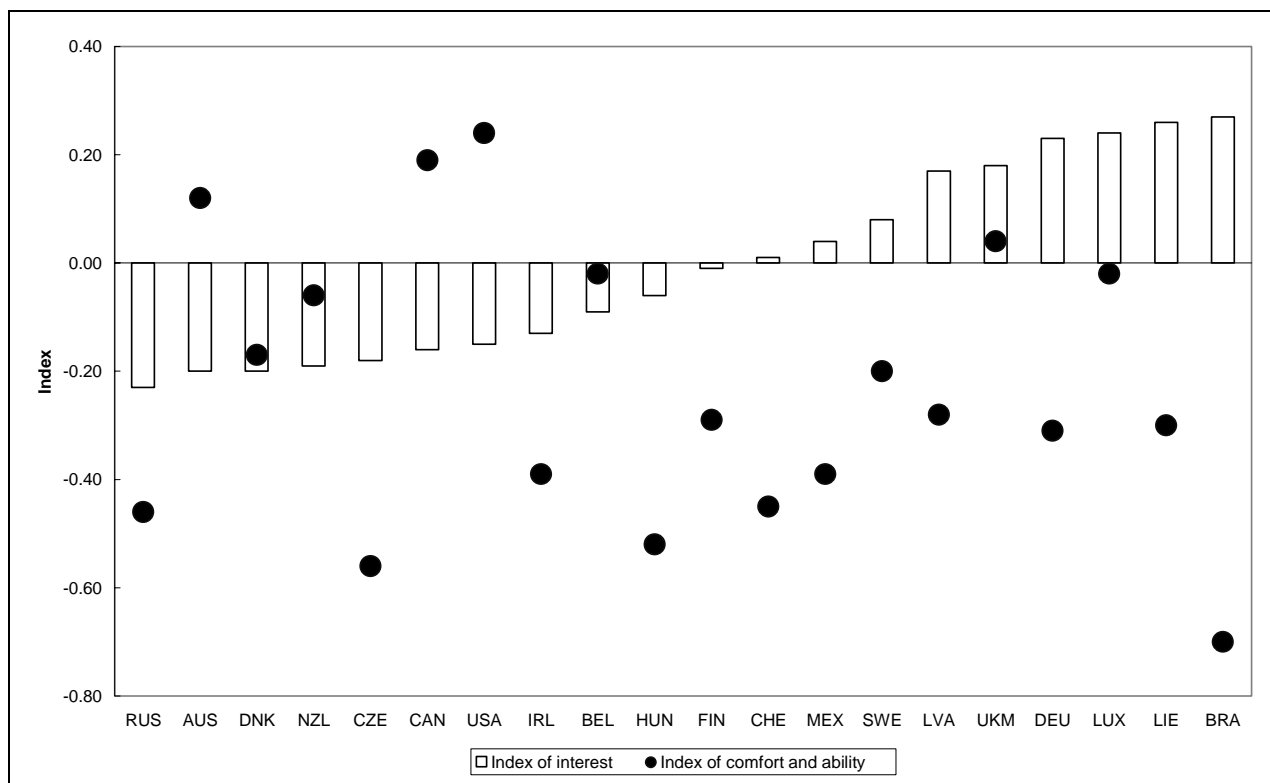


1. The index is standardized to an OECD-wide mean of 0.0 and a standard deviation of 1.0. Values are arranged in order of low achievers' perceived comfort and ability.

Do low achievers report themselves to be less comfortable with and to have less ability in using computers than other students?

Table 7 and Figure 2 show the relationship between the PISA index of comfort with and perceived ability to use computers and achievement level on the combined reading literacy scale. Whilst there is no significant trend for low achievers to be less interested in computers than other students in PISA 2000 countries, there is a strong trend for them to feel less comfortable using computers than other students, and to feel that they have less ability in using them than other students. This is apparent in 14 of the 31 PISA 2000 countries, both those where overall comfort with computers is relatively high, such as Australia and the United Kingdom, and those where overall comfort is relatively low, such as Hungary and Switzerland. The only country in which the reverse relationship is found, with low achievers reporting themselves to feel more comfortable and able with computers than other students is Luxembourg, a country in which reported comfort and ability are low for all achievement levels. In Australia, as an example, the index of interest in computers is about the same for low achievers as for high achievers (Table 6). However high achievers report themselves to be around five times more comfortable with and able in using computers than do low achievers. Similarly, in Luxembourg the perceived comfort and ability index is nearly eight times as high among high achievers as among low achievers. And in Germany the two groups feel similarly uncomfortable and lacking in ability to use computers, with both falling below the OECD average.

Figure 3: Low achievers’ interest in and perceived comfort with and ability to use computers



The index of interest in computers and the index of perceived comfort with and ability to use computers are both standardised to an OECD-wide mean of 0.0 and a standard deviation of 1.0. values are arranged in order of low achievers’ interest in computers.

It is also clear, from Figure 3, that in nearly all OECD countries low achievers’ reported level of comfort and ability to use computers is significantly below their reported level of interest in computers. Australia, Canada, Denmark, New Zealand, the United Kingdom and the USA are the only significant exceptions.

This is an intriguing finding that might be related to the extent to which English has become the *lingua franca* of common computer software.

Do low achievers use computers for different purposes than other students?

The PISA 2000 Information Technology Questionnaire contains an index of the overall level of use of ICT. In addition, it contains nine specific questions that explore specific aspects of ICT use such as spreadsheets, games, and the Internet. Tables 8.1 to 8.10 show the relationship between achievement on the combined reading literacy scale and both the overall index of use and the nine specific types of ICT use. Table 8.1 shows that the overall level of computer use by low achieving students is, in most of the PISA 2000 countries, not significantly different from that of other students. The exceptions are Sweden, Denmark and Finland, where low achievers use computers significantly more than other students, and Brazil and Russia, where they use them significantly less.

When specific types of computer use are examined, at least some differences are apparent between low achievers and others.

- *Internet use* is more common by higher achievers, and less common by lower achievers, in the United States, Mexico, Australia, Switzerland, Brazil and Canada. The general direction of results is similar in most other countries, although not statistically significant;
- The use of computers for electronic *communication* is less common by low achievers and more common by high achievers in the Mexico, Switzerland, Liechtenstein, Canada and the United Kingdom. The general direction of results is similar in most other countries, although not statistically significant;
- There is a very strong and significant trend – observed in 19 of the 23 countries whose students completed the Computer Familiarity Questionnaire – for the lowest achievers to report that they use computers for programming more often than do high achievers;
- In nearly all countries the general pattern is for low achievers to report that they use computers for games more frequently than do high achievers, although the trend is statistically significant only in the Czech Republic;
- In nearly all countries the general pattern is for high achievers to report that they use computers for word processing more often than do low achievers, but the trend is statistically significant only in Liechtenstein and Mexico;
- In Sweden and Finland low achievers report that they use computers for spreadsheets more often than do high achievers, and there is a similar although not statistically significant pattern in many other countries;
- There is a common pattern in many countries for low achievers to report more frequent use of computers for *drawing and graphics*, although this is statistically significant only in Finland; and
- In four Scandinavian countries (Denmark, Finland, Norway and Sweden) low achievers are more likely than high achievers to report that they use *educational software*. This trend is not significant in other countries, although the pattern is in the same direction in most.

4 CONCLUSIONS AND POLICY IMPLICATIONS

The analysis that has been reported here carries some messages that are positive. There is, for example, a number of countries whose ICT resourcing practices or policies have resulted in the schools in which low achievers are located having equal levels of ICT resources to those schools in which high achievers are located. And there are many countries in which it seems that the access that low achievers have to ICT within schools differs little from the ICT access that high achievers enjoy. And this same level of equal access for low and high achievers also applies, in some countries, in those schools where computers are relatively scarce.

On the other hand there are some countries in which the schools that low achievers are found in have the lowest level of ICT resources; where, within schools, the lowest achievers receive the least access to ICT; where they receive the least access when computers are scarce; and where school principals feel that the lack of ICT resources hinders the learning of 15-year olds. Many of these problems of low achievers struggling to get access to ICT within schools seem to be more apparent in countries with relatively low levels of GDP, but this is not always the case. Some, although generally not all, of these problems can be seen in relatively wealthy OECD countries such as Australia and France. Certainly the analysis presented here makes it clear that where low achievers do get less access to ICT in school than other students, there are some cases where the problem is primarily a function of the distribution of resources between schools, and other cases where it is largely a function of the ways in which resources are distributed within schools. Each presents quite different challenges for resourcing policies.

There are, in addition, some countries – of which Germany is an example – where low achievers generally enjoy higher access to ICT within schools than other students. Why this is so is not clear from the present analysis. It could be a function of the interaction between the ways in which low achievers are streamed into different types of schools interacting with ICT resourcing policies and with other factors such as policies and programmes for training teachers in ICT use. Or it could be the result of deliberate policies, based upon a belief in the educational benefit of ICT in improving achievement levels, that ICT resources should be concentrated upon those who need them most. Again, the analysis reported here does not shed a great deal of light on this issue. However it could be pointed out in this context that it is in four Scandinavian countries (Denmark, Finland, Norway and Sweden) where low achievers are the most likely, when compared to other students, to use educational software.

It is also not clear, from either the present analysis or other evidence, that the relative concentration of ICT resources upon low achievers should necessarily be a goal of policy. Certainly the importance of ICT skills in modern knowledge-based economies and societies argues that low achievers' access to ICT in order to develop ICT literacy and employment-relevant ICT skills is an important equity issue. However whether relatively greater access is required in order to improve overall levels of achievement is another matter. Evidence presented to this workshop, and elsewhere, hints at the value of ICT for raising achievement levels, but perhaps in policy terms this argues for no more than equal access.

Another positive message from the analysis is that there seems no general or significant trend for low achievers to be less interested in computers than high achievers. There are, however, hints from the results that they like to use them in different ways (using non-verbal images for example), and there is strong evidence that in many countries they feel far less confident and competent when using computers than do high achievers, and that their level of perceived confidence and competence is far lower than their reported interest. This strongly points to the importance of concerted effort to find ways to better connect low achievers with ICT, or to better engage the interest in ICT that they clearly have. In this context, the finding that low achievers' perceived confidence and competence in using ICT is higher than their reported interest in ICT in English-speaking countries, but that elsewhere the reverse is generally the case, is intriguing. It is open to speculation on the extent to which this is a function of the fact that the dominant

language for both the most common operating systems and the more commonly used software is English. If this is part of the reason, it helps to reinforce calls that are commonly made by educators for the availability of more appropriate educational software, and for more educational software to be written in languages other than English.

While the analysis shows that there are inequities within and between schools in the access that low achievers have there to ICT, the more important finding is that, in general, inequities in access and use seem to be far greater in the home than they are in the school. This helps to emphasise the importance of the school in giving low achievers access to ICT. It emphasises the importance of schools and school systems working actively to combat the limited access that low achievers, in many countries, have to ICT in their home: fewer computers; more limited Internet access; and less educational software. There are many examples of programmes that help to do this, and the evidence here constitutes an argument for their continuation and their more careful targeting on low achievers. These include programmes to lend computers to students; after-school access programmes; more targeted use of ICT in school libraries; and the stimulation of community access points that low achievers can easily access. In re-emphasising the key role that schools can play in providing ICT access and ICT skills, and in helping low achievers to use ICT to improve their levels of achievement, the findings help to counteract the common impression that schools do not need to worry about many students' ICT access and skills, because they are thought to pick up these skills and gain this access readily outside of the home. This is clearly not the case for low achieving students in many OECD countries. Pertinent here is recent Norwegian research which shows that many school students are not as able at using ICT as they claim, and that many teachers are far more competent in using ICT than they believe (Ministry of Education and Research, 2002).

Finally, the analysis shows that in the case of low achieving students, the scale of the digital divide varies widely across countries, and that it need not be evidently related either to national wealth or to the ease and cheapness of ICT access. This is particularly the case within the home. For example in the United States it seems to be surprisingly large. There, the gap between the interest in computers of the lowest and the highest achievers is much larger than in all other OECD countries. More significantly, in the United States, low achievers use computers at home far less than do high achievers, have fewer computers in the home, and have less home Internet access.

REFERENCES

- FELSTEAD, A., GALLIE, D. and GREEN, F. (2000)
“Computers are even more important than you thought: An analysis of the changing skill-intensity of jobs”, *Discussion Paper* No. 439, Centre for Economic Performance, University of London.
- MINISTRY OF EDUCATION AND RESEARCH (2002)
Information and communication Technology (ICT) competency among pupils and teachers: A study of the ICT competency among pupils and teachers in Norway and their own evaluation of this, mimeo, Oslo.
- NICKELL, S. and LAYARD, R. (1998)
“Labour market institutions and economic performance”, *Discussion Paper* No. 407, Centre for Economic Performance, University of London.
- NORTH CENTRAL REGIONAL EDUCATIONAL LABORATORY (1997)
Critical Issue: Using Technology to Enhance Engaged Learning for At-Risk Students,
<http://www.ncrel.org/sdrs/areas/issues/students/atrisk/at400.htm>
- OECD (2000):
Learning to Bridge the Digital Divide, Paris.
- OECD (2001a)
Learning to Change: ICT in Schools, Paris.
- OECD (2001b)
Learning and Skills for Life: First Results from PISA 2000, Paris.
- PELGRUM, W. (2003):
“Promoting equity through ICT. What can international assessments contribute to help fight low achievement?”, Paper prepared for a joint OECD/Hungary workshop on “Promoting Equity Through ICT in Education: Projects, Problems, Prospects” Budapest, 12-13 June.
- WILHELM, A.G. (2003):
“Everyone should know the basics: Equalizing opportunities and outcomes for disadvantaged youths through ICT in education”, Paper prepared for a joint OECD/Hungary workshop on “Promoting Equity Through ICT in Education: Projects, Problems, Prospects” Budapest, 12-13 June.

Appendix 1: Two ways of defining low achievers on the PISA combined reading literacy scale

	<u>1. Per cent of all students at Level 1 or below</u>	<u>2. Per cent of students within each national lowest quartile at:</u>				
		Level 1 and below	Level 2	Level 3	Levels 4 and 5	Total
<u>OECD countries</u>						
Australia	12.46	49.73	50.26	0.00	0.00	100.0
Austria	14.62	58.33	41.67	0.00	0.00	100.0
Belgium	18.99	75.88	24.13	0.00	0.00	100.0
Canada	9.56	38.21	61.79	0.00	0.00	100.0
Czech Republic	17.50	69.93	30.07	0.00	0.00	100.0
Denmark	17.91	71.53	28.47	0.00	0.00	100.0
Finland	6.95	27.78	56.95	15.27	0.00	100.0
France	15.19	60.68	39.31	0.00	0.00	100.0
Germany	22.63	90.40	9.60	0.00	0.00	100.0
Greece	24.41	97.56	2.44	0.00	0.00	100.0
Hungary	22.71	90.67	9.33	0.00	0.00	100.0
Iceland	14.53	58.03	41.97	0.00	0.00	100.0
Ireland	11.04	44.10	55.90	0.00	0.00	100.0
Italy	18.92	75.57	24.43	0.00	0.00	100.0
Japan	10.08	40.26	59.74	0.00	0.00	100.0
Korea	5.75	22.94	74.31	2.75	0.00	100.0
Luxembourg	35.07	100.00	0.00	0.00	0.00	100.0
Mexico	44.14	100.00	0.00	0.00	0.00	100.0
Netherlands	n.a.	38.03	61.96	0.00	0.00	100.0
New Zealand	13.70	54.87	45.13	0.00	0.00	100.0
Norway	17.49	69.86	30.14	0.00	0.00	100.0
Poland	23.23	92.88	7.12	0.00	0.00	100.0
Portugal	26.25	100.00	0.00	0.00	0.00	100.0
Spain	16.27	64.99	35.01	0.00	0.00	100.0
Sweden	12.58	50.26	49.73	0.00	0.00	100.0
Switzerland	20.37	81.38	18.62	0.00	0.00	100.0
United Kingdom	12.85	51.31	48.69	0.00	0.00	100.0
United States	17.92	71.53	28.47	0.00	0.00	100.0
<i>OECD average</i>	17.90	65.95	35.4	0.64	0.00	100.00
<u>Non-OECD countries</u>						
Brazil	55.80	100.00	0.00	0.00	0.00	100.0
Latvia	30.56	100.00	0.00	0.00	0.00	100.0
Liechtenstein	22.13	87.63	12.37	0.00	0.00	100.0
Russia	27.42	100.00	0.00	0.00	0.00	100.0

APPENDIX 2: PISA DATA ELEMENTS USED IN THE ANALYSIS

1. Are low achievers located in schools with lower or higher ratios of students to computers than are other students?

By level of proficiency on the combined reading literacy scale:

Ratio of students to computers

2. Do low achievers perceive that they have less access to computers at school than other students?

By level of proficiency on the combined reading literacy scale:

- i) "How often is there a computer available for you to use at school?" [IT 1b]
- ii) "How often do you use a computer at school?" [IT4b]
- iii) "At your school, about how often do you use computers?" [ST39b]

3. Within schools, do low achievers seem to gain less access to computers than other students?

Within schools, divided within each country into the top quartile, middle half and bottom quartile in terms of the number of students per computer, by level of proficiency on the combined reading literacy scale:

- i) "How often is there a computer available for you to use at school?" [IT 1b]
- ii) "How often do you use a computer at school?" [IT4b]
- iii) "At your school, about how often do you use computers?" [ST39b]

4. Are low achievers likely to be located in schools in which principals report that learning is hindered by a lack of computers for instruction?

By level of proficiency on the combined reading literacy scale:

- i) "In your school, how much is learning of 15-year-old students hindered by lack of computers for instruction?" [SC11e]

5. Do low achievers have less access to and make less use of computers at home than other students?

By level of proficiency on the combined reading literacy scale:

- i) "How often is there a computer available for you to use at home?" [IT1a]
- ii) "How often do you use a computer at home?" [IT4a]
- iii) "In your home, do you have educational software?, (% yes) [ST21c]
- iv) "In your home, do you have a link to the Internet?", (% yes) [ST21d]
- v) "How many computers do you have in your home?" [ST22d]

6. Do low achievers have lower interest in computers than other students?

By level of proficiency on the combined reading literacy scale:

Index of interest in computers (COMATT). This index was derived from students' responses to the following statements: It is very important to me to work with a computer; To play or work with a computer

is really fun; I use a computer because I am very interested in this; and, I forget the time, when I am working with the computer. It is based on questions IT07, IT08, IT09, and IT10.

7. Do low achievers report themselves to be less comfortable with and to have less ability in using computers than other students?

By level of proficiency on the combined reading literacy scale:

Index of comfort with and perceived ability to use computers (COMAB). This index was derived from students' responses to the following questions: How comfortable are you with using a computer?; How comfortable are you with using a computer to write a paper?; How comfortable are you with taking a test on a computer?; and, If you compare yourself with other 15-year-olds, how would you rate your ability to use a computer? It was based on questions IT02a, IT02b, IT02c, and IT03.

8. Do low achievers use computers for different purposes than other students?

By level of proficiency on the combined reading literacy scale:

i) *Index of computer usage (COMUSE).* This index was derived from students' responses to the frequency to which they use the computer for the following purposes: to help them learn school material; for programming; for word processing (examples of software packages were given); spreadsheets (examples of software packages were given); drawing, painting or graphics; and, educational software. It was based on questions IT05c, IT05Qd, IT06Qb, IT06Qc, IT06Qc, and IT06Qe.

ii) "How often do you use the Internet?" [IT5a]

iii) "How often do you use a computer for electronic communication?" [IT5b]

iv) "How often do you use the computer to help you learn school material?" [IT5c]

v) "How often do you use the computer for programming?" [IT5d]

vi) "How often do you use games?" [IT6a]

vii) "How often do you use <word processing>?" [IT6b]

viii) "How often do you use <spreadsheets>?" [IT6c]

ix) "How often do you use <drawing, painting or graphics>?" [IT6d]

x) "How often do you use <educational software>?" [IT6e]

APPENDIX 3: STATISTICAL TABLES

1. Number of students per computer by level of proficiency on the combined reading literacy scale
- 2.1 Availability of computers for use at school by mean score on the combined reading literacy scale
- 2.2 Frequency with which computers are used at school by mean score on the combined reading literacy scale (1)
- 2.3 Frequency with which computers are used at school by mean score on the combined reading literacy scale (2)
- 3.1 Within schools with relatively few computers, the availability of computers by level of proficiency on the combined reading literacy scale
- 3.2 Within schools with relatively few computers, the frequency with which computers are used by level of proficiency on the combined reading literacy scale (1)
- 3.2 Within schools with relatively few computers, the frequency with which computers are used by level of proficiency on the combined reading literacy scale (2)
4. Principals' report of the extent to which 15-year-olds' learning is hindered by lack of computers by level of proficiency on the combined reading literacy scale
- 5.1 Frequency of computer availability in the home by mean score on the combined reading literacy scale
- 5.2 Frequency of computer use in the home by mean student performance on the combined reading literacy scale
- 5.3 Availability of educational software in the home by level of proficiency on the combined reading literacy scale
- 5.4 Availability of an Internet link in the home by level of proficiency on the combined reading literacy scale
- 5.5 Average number of computers in the home by level of proficiency on the combined reading literacy scale
6. Index of interest in computers by level of proficiency on the combined reading literacy scale
7. Index of perceived comfort with and ability to use computers by level of proficiency on the combined reading literacy scale
- 8.1 Index of computer usage by level of proficiency on the combined reading literacy scale
- 8.2 Frequency of Internet use by mean student performance on the combined reading literacy scale
- 8.3 Frequency of use of computers for electronic communication by mean student performance on the combined reading literacy scale
- 8.4 Frequency with which computers are used for learning school material by mean student performance on the combined reading literacy scale
- 8.5 Frequency with which computers are used for programming by mean student performance on the combined reading literacy scale

- 8.6 Frequency with which computers are used for games by mean student performance on the combined reading literacy scale
- 8.7 Frequency with which computers are used for word processing by mean student performance on the combined reading literacy scale
- 8.8 Frequency with which computers are used for spreadsheets by mean student performance on the combined reading literacy scale
- 8.9 Frequency with which computers are used for drawing, painting or graphics by mean student performance on the combined reading literacy scale
- 8.10 Frequency with which computers are used for educational software by mean student performance on the combined reading literacy scale

NOTES:

1. Within each table, values are arranged in order of the slope of the line fitted through the points in the header row of the table. The value of the slope is shown in the second column from the right.
2. For each country, the significance of the relationship between student achievement and the variable of concern in the table was tested by fitting a line through the row values and the values in the header row and testing the significance of the difference between the slope of the line and zero. The resulting F values are shown in the far right column of each table. Those significant at at least the five per cent level are shown in bold.

Table 1: Number of students per computer by level of proficiency on the combined reading literacy scale

	Level 1 & below	Level 2	Level 3	Levels 4 & 5	Slope	F
Brazil	276.18	210.17	138.99	87.79	-63.64	468.36
Mexico	128.69	71.22	39.90	21.24	-35.37	32.43
Poland	59.89	38.67	29.69	32.46	-9.13	5.79
Czech Republic	33.38	31.27	23.28	17.87	-5.45	47.17
France	15.06	13.96	11.52	10.36	-1.65	79.50
Hungary	16.18	10.91	10.18	11.40	-1.51	2.09
Latvia	33.06	30.41	30.78	31.39	-0.46	0.71
Austria	11.79	9.70	9.45	10.39	-0.44	0.85
Switzerland	12.88	12.98	12.39	11.82	-0.38	10.34
Luxembourg	10.16	9.35	9.18	9.42	-0.24	2.05
Iceland	11.05	10.97	10.60	10.46	-0.21	31.76
New Zealand	6.52	6.65	6.56	6.52	-0.01	0.07
Australia	5.79	6.11	6.06	5.84	0.01	0.01
United Kingdom	7.78	7.90	7.96	8.10	0.10	96.33
United States	5.64	5.72	6.03	5.92	0.11	4.39
Norway	6.13	6.58	6.49	6.69	0.16	5.05
Finland	9.31	9.33	9.65	9.76	0.17	18.56
Sweden	10.08	11.51	12.09	11.57	0.51	2.67
Lichtenstein	7.45	6.60	7.39	9.54	0.71	2.21
Ireland	13.69	15.25	15.98	15.98	0.76	9.49
Spain	22.24	23.23	23.43	25.24	0.92	18.56
Denmark	8.42	9.23	10.38	11.23	0.96	439.54
Belgium	13.32	12.87	14.49	16.36	1.07	7.63
Netherlands	8.28	9.22	10.33	11.91	1.20	134.71
Germany	21.23	23.37	23.92	27.18	1.84	27.35
Korea	5.81	7.60	10.21	11.42	1.94	114.34
Greece	56.97	54.75	58.08	62.39	1.96	3.28
Japan	10.20	11.81	14.52	16.75	2.24	226.31
Italy	12.77	14.46	17.47	19.44	2.30	177.78
Portugal	61.64	71.06	81.28	82.77	7.36	26.74
Russia	94.08	108.83	118.30	127.33	10.92	127.57
Total	36.06	21.60	16.13	14.57	-6.99	11.40
Average	28.86	21.64	18.53	16.49	-4.02	22.56

F_{.05}=19.25; F_{.01}=99.25

Table 2.1: Availability of computers for use at school¹ by mean score on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
Denmark	510.50	493.07	498.95	492.40	389.24	24.32	4.56
Czech Republic	552.86	520.49	504.64	481.43	462.68	21.94	236.85
Australia	544.30	521.79	503.76	499.69	471.70	16.73	74.08
Liechtenstein	508.64	481.76	480.64	488.69	435.26	13.98	6.24
Canada	544.84	538.29	520.95	509.33	494.85	12.89	220.44
United Kingdom	534.77	528.53	520.14	508.15	486.81	11.63	46.61
New Zealand	544.32	532.74	520.81	519.21	493.23	11.57	36.01
Latvia	480.90	467.00	474.20	442.22	436.07	11.44	14.74
Switzerland	530.12	494.89	487.74	484.94	479.39	11.14	9.57
Mexico	433.03	452.05	424.16	438.66	404.47	7.05	1.97
United States	519.38	511.25	512.36	508.13	486.28	6.93	9.68
Luxembourg	468.01	460.14	456.44	447.69	443.57	6.13	203.21
Hungary	501.29	481.24	476.68	485.76	468.76	6.05	4.97
Belgium	521.25	515.93	534.70	529.46	490.24	4.85	0.73
Brazil	418.21	408.68	418.68	406.61	397.25	4.40	4.65
Russian Federation	445.85	481.59	491.11	459.02	446.89	2.05	0.08
Ireland	526.18	534.58	538.65	526.21	520.86	1.90	0.64
Finland	550.66	545.76	546.74	559.58	536.04	1.54	0.27
Sweden	515.01	517.51	521.04	522.83	506.37	1.20	0.28
Germany	475.11	487.73	492.60	511.06	504.52	-8.22	16.23
Total	514.92	501.37	500.78	501.34	459.76	11.04	6.85
Average	523.64	507.39	504.60	506.22	473.62	10.12	10.35

1. "How often is there a computer available for you to use at school?", [IT1b]
 $F_{.05}=9.01$; $F_{.01}=28.24$

Table 2.2: Frequency with which computers are used at school¹ by mean score on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
Czech Republic	521.84	520.02	515.19	484.85	476.02	12.68	20.04
Denmark	494.18	498.86	517.25	505.08	443.45	9.52	1.18
Mexico	429.25	458.93	437.53	445.17	405.36	6.15	0.94
Australia	532.74	527.24	538.54	531.71	513.97	3.31	1.42
Latvia	442.53	471.97	476.67	448.21	443.09	2.26	0.15
Canada	529.71	531.75	542.22	543.34	526.53	-0.52	0.04
Russian Federation	430.11	484.25	491.90	456.13	447.85	-0.74	0.01
United Kingdom	520.56	524.00	538.22	540.48	520.44	-1.62	0.22
United States	501.73	496.54	532.61	529.71	497.27	-2.43	0.14
Ireland	507.06	531.28	538.13	527.42	525.66	-3.33	0.79
Switzerland	477.47	485.09	506.32	499.88	494.33	-4.85	2.40
Hungary	469.78	481.46	484.49	481.18	497.32	-5.48	10.32
Finland	527.89	542.47	552.91	566.96	545.45	-5.96	2.29
New Zealand	519.66	514.82	540.72	549.52	535.24	-6.59	3.20
Luxembourg	427.01	453.39	467.18	460.57	462.06	-7.73	4.33
Sweden	493.09	509.48	529.03	530.98	527.28	-8.99	9.27
Brazil	367.65	365.71	431.13	417.77	399.00	-11.48	1.86
Belgium	451.16	502.56	539.89	534.40	508.03	-14.56	2.23
Norway	446.54	488.12	521.08	525.29	501.26	-14.66	3.44
Liechtenstein	464.16	451.81	490.25	520.87	502.99	-14.67	6.36
Germany	444.07	473.70	493.35	514.41	507.13	-16.68	19.31
Total	497.05	493.54	520.68	523.10	470.40	2.37	0.09
Average	497.43	502.60	519.46	523.36	489.83	-0.56	0.01

1. "How often do you use a computer at school?", [IT4b]
 $F_{.05}=9.01$; $F_{.01}=28.24$

Table 2.3: Frequency with which computers are used at school¹ by variation in student performance on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
Liechtenstein	473.02	472.02	495.20	488.33	525.26	-12.08	10.35
Sweden	502.02	515.07	528.13	537.13	531.58	-8.12	13.79
Germany	479.35	483.13	479.03	499.37	508.70	-7.49	10.74
New Zealand	520.08	519.82	534.88	548.15	542.06	-7.23	11.77
Norway	479.55	512.11	516.69	519.86	509.57	-6.78	2.36
Greece	460.75	478.89	461.62	469.50	495.16	-5.94	2.28
Finland	540.72	545.82	545.01	560.28	554.00	-4.10	6.44
Italy	474.97	501.94	480.72	487.64	501.69	-3.91	1.04
France	496.70	514.18	504.17	513.16	513.62	-3.28	2.48
Japan	518.11	513.40	525.47	528.16	526.54	-3.16	5.07
United Kingdom	517.69	530.05	531.56	542.11	524.97	-2.66	0.84
Korea	519.59	533.03	518.07	532.72	527.86	-1.62	0.45
Portugal	465.73	476.08	471.99	474.73	472.96	-1.31	1.10
Canada	537.28	527.88	536.45	541.30	532.77	-0.44	0.06
Switzerland	494.71	501.88	491.71	494.22	497.60	0.19	0.02
Luxembourg	448.17	460.19	442.35	439.11	456.66	0.41	0.02
Belgium	500.05	537.13	506.73	514.84	498.74	2.49	0.20
Hungary	483.88	488.08	461.01	472.85	477.93	2.71	0.60
Iceland	505.92	519.69	502.30	515.35	488.31	3.96	1.06
Australia	537.23	525.18	528.53	523.84	517.59	4.06	11.66
Ireland	532.67	541.37	515.43	514.83	525.48	4.09	1.44
Austria	514.48	509.81	505.85	500.20	496.96	4.47	603.91
Spain	508.62	514.76	521.92	512.93	486.00	4.71	1.27
Brazil	510.97	504.99	485.31	496.01	481.86	6.72	8.09
Latvia	417.20	438.90	405.10	407.23	394.71	7.67	3.32
Netherlands	476.76	478.62	446.15	455.32	443.87	8.91	7.73
Czech Republic	541.44	554.60	540.62	526.77	507.25	9.62	7.59
Russian Federation	520.89	522.31	496.83	490.26	477.77	11.83	34.70
Poland	489.53	497.62	455.61	458.95	449.59	11.85	8.71
Denmark	495.15	514.95	482.95	454.75	451.75	14.70	8.83
Mexico	498.86	503.83	502.27	497.89	421.42	16.08	3.14
United States	463.95	461.52	446.30	430.32	397.18	16.47	28.11
Total	505.37	510.29	510.75	508.06	491.59	2.98	1.65
Average	504.02	511.14	506.25	507.80	493.37	2.46	1.50

1. "At your school, about how often do you use computers?", ST39b
 $F_{.05}=9.01$; $F_{.01}=28.24$

Table 3.1: Within schools with relatively few computers⁵, the availability of computers¹ by level of proficiency on the combined reading literacy scale (Mean index in which "Never or hardly ever" = 0, "A few times a year" = 1, "About once a month" = 2, "Several times a month" = 3, "Several times a week" = 4)

	Level 1 and below	Level 2	Level 3	Levels 4 and 5	Slope	F
Germany	1.85	1.81	1.64	1.56	-0.10	38.35
Sweden	3.10	3.05	3.04	3.07	-0.01	0.63
Latvia	2.25	2.22	2.38	2.27	0.02	0.40
Liechtenstein	2.35	2.77	2.81	2.41	0.02	0.03
Finland	2.77	2.75	2.96	2.91	0.06	3.25
Luxembourg	2.27	2.45	2.53	2.51	0.08	6.40
Belgium	2.06	2.05	2.33	2.27	0.09	4.05
United States	2.79	3.05	3.19	3.09	0.10	3.27
Mexico	2.64	2.61	2.76	2.94	0.11	9.07
Ireland	1.84	1.80	2.04	2.15	0.12	9.76
Russian Federation	1.63	1.63	1.85	1.96	0.12	17.29
United Kingdom	2.86	3.05	3.18	3.30	0.15	155.74
Australia	3.20	3.37	3.55	3.64	0.15	107.14
Denmark	3.15	3.36	3.52	3.60	0.15	53.40
Switzerland	2.45	2.39	2.60	2.97	0.18	6.69
Hungary	2.55	2.79	2.95	3.13	0.19	257.86
Brazil	1.63	1.83	1.91	2.25	0.19	31.05
New Zealand	2.78	3.01	3.23	3.40	0.21	441.47
Czech Republic	1.54	2.10	2.51	2.85	0.43	151.66
Total	2.78	2.92	3.12	3.15	0.13	30.27
Average	2.68	2.83	2.99	3.15	0.16	8,216.33

(Mean index in which "Never or hardly ever" = 0, "A few times a year" = 1, "About once a month" = 2, "Several times a month" = 3, "Several times a week" = 4)

1. "How often is there a computer available for you to use at school?" [IT1b]

F_{.05}=19.25; F_{.01}=99.25

5. Defined as schools falling within the top students per computer quartile within each country.

Table 3.2: Within schools with relatively few computers⁶, the frequency with which computers are used at school¹ by level of proficiency on the combined reading literacy scale

	Level 1 and below	Level 2	Level 3	Levels 4 and 5	Slope	F
Luxembourg	2.27	2.11	1.92	1.68	-0.20	237.14
Sweden	2.81	2.69	2.44	2.30	-0.18	106.32
Norway	2.48	2.20	2.07	1.95	-0.17	40.09
Germany	1.74	1.68	1.54	1.49	-0.09	53.88
United States	2.32	2.25	2.19	2.10	-0.07	288.00
Switzerland	2.10	1.90	1.90	1.89	-0.06	3.53
Brazil	1.27	1.33	1.20	1.17	-0.04	2.97
New Zealand	2.24	2.28	2.29	2.14	-0.03	0.85
Finland	2.46	2.51	2.56	2.48	0.01	0.24
Liechtenstein	2.21	2.34	2.27	2.28	0.01	0.26
Latvia	2.08	2.05	2.21	2.09	0.02	0.28
Denmark	2.92	2.93	3.03	2.96	0.02	0.97
Australia	2.53	2.63	2.63	2.62	0.03	2.13
United Kingdom	2.35	2.51	2.58	2.44	0.03	0.50
Ireland	1.55	1.51	1.56	1.68	0.04	3.02
Belgium	2.01	2.01	2.27	2.15	0.07	1.92
Mexico	2.25	2.17	2.34	2.47	0.08	4.52
Russian Federation	1.47	1.52	1.78	1.84	0.14	22.26
Hungary	2.46	2.66	2.82	2.99	0.18	875.00
Czech Republic	1.39	1.86	2.18	2.35	0.32	45.51
Total	2.26	2.20	2.26	2.23	0.00	0.04
Average	2.29	2.29	2.33	2.23	-0.01	0.48

(Mean index in which "Never or hardly ever" = 0, "A few times a year" = 1, "About once a month" = 2, "Several times a month" = 3, "Several times a week" = 4)

1. "How often do you use a computer at school?" [IT4b]

F_{.05}=19.25; F_{.01}=99.25

6. Defined as schools falling within the top students per computer quartile within each country.

Table 3.3 Within schools with relatively few computers⁷, the frequency with which computers are used at school¹ by level of proficiency on the combined reading literacy scale

	Level 1 and below	Level 2	Level 3	Levels 4 and 5	Slope	F
Sweden	1.33	1.19	0.94	0.85	-0.17	66.89
Luxembourg	2.15	1.97	1.79	1.71	-0.15	75.00
Portugal	2.51	2.25	2.11	2.08	-0.14	15.46
Norway	1.65	1.49	1.44	1.27	-0.12	53.04
Liechtenstein	1.46	1.21	1.11	1.18	-0.09	3.45
Germany	2.19	2.13	1.93	1.95	-0.09	10.48
New Zealand	1.65	1.53	1.42	1.52	-0.05	1.77
United Kingdom	1.10	1.02	0.92	1.04	-0.03	0.61
Greece	1.90	1.83	1.71	1.85	-0.03	0.46
Switzerland	1.69	1.79	1.72	1.67	-0.01	0.23
Finland	1.17	1.09	1.12	1.17	0.00	0.02
Italy	1.01	0.87	0.85	1.06	0.01	0.05
Brazil	2.32	2.40	2.21	2.43	0.01	0.07
Iceland	1.16	1.17	1.14	1.24	0.02	1.27
France	2.32	2.34	2.08	2.50	0.03	0.09
Australia	0.95	1.02	0.91	1.15	0.05	1.13
United States	1.50	1.31	1.31	1.75	0.08	0.55
Latvia	1.85	1.74	1.94	2.04	0.08	3.05
Netherlands	1.83	2.04	1.85	2.16	0.08	1.49
Denmark	0.63	0.58	0.76	0.88	0.09	7.57
Ireland	2.01	2.17	2.21	2.37	0.11	43.56
Austria	0.64	0.86	0.80	1.08	0.13	7.89
Japan	1.97	2.22	2.11	2.47	0.14	5.16
Belgium	1.32	1.25	1.53	2.01	0.24	7.20
Mexico	1.08	1.33	1.60	1.80	0.24	573.29
Korea	0.74	0.77	1.00	1.50	0.25	11.36
Poland	1.04	1.08	1.19	1.86	0.26	5.94
Spain	1.97	2.15	2.42	2.75	0.26	120.14
Russian Federation	1.93	2.17	2.55	2.74	0.28	130.08
Hungary	0.53	0.72	0.99	1.40	0.29	67.54
Czech Republic	1.33	1.60	2.08	2.73	0.47	60.54
Total	1.43	1.44	1.48	1.67	0.08	6.55
Average	1.37	1.29	1.32	1.50	0.04	1.04

(Mean index in which "Never or hardly ever" = 0, "A few times a year" = 1, "About once a month" = 2, "Several times a month" = 3, "Several times a week" = 4)

"At your school, about how often do you use computers?" [SC39b]

F_{.05}=19.25; F_{.01}=99.25

7. Defined as schools falling within the top students per computer quartile within each country.

Table 4: Principals' report of the extent to which 15 year-olds' learning is hindered by lack of computers¹ by level of proficiency on the combined reading literacy scale (Mean index)²

	Level 1 and below	Level 2	Level 3	Levels 4 and 5	Slope	F
Liechtenstein	1.77	1.38	0.82	0.80	-0.35	20.26
Mexico	2.27	1.88	1.61	1.25	-0.33	456.33
Brazil	1.95	1.72	1.44	1.14	-0.27	578.28
France	1.17	1.05	0.89	0.79	-0.13	281.67
United Kingdom	1.69	1.65	1.62	1.45	-0.07	10.51
Germany	1.55	1.52	1.42	1.37	-0.06	49.95
Russian Federation	2.39	2.34	2.27	2.20	-0.06	341.33
Japan	1.18	1.09	1.03	1.00	-0.06	40.00
Norway	1.70	1.58	1.56	1.53	-0.05	10.68
Spain	0.99	0.94	0.95	0.81	-0.05	6.64
Iceland	1.34	1.23	1.20	1.21	-0.04	4.79
Sweden	1.51	1.42	1.39	1.38	-0.04	10.50
Australia	1.09	1.03	0.98	0.97	-0.04	25.09
Czech Republic	1.15	1.12	1.07	1.05	-0.03	81.67
United States	0.94	0.94	0.89	0.86	-0.03	17.89
Latvia	1.30	1.37	1.29	1.23	-0.03	1.48
New Zealand	1.25	1.27	1.22	1.18	-0.03	5.54
Switzerland	0.94	0.84	0.82	0.86	-0.03	1.37
Netherlands	1.28	1.36	1.23	1.24	-0.03	0.85
Austria	1.30	1.24	1.23	1.22	-0.03	8.33
Hungary	0.53	0.45	0.37	0.48	-0.02	0.49
Canada	1.05	1.03	1.01	1.00	-0.02	96.33
Luxembourg	1.06	0.92	0.95	1.00	-0.01	0.22
Greece	1.85	1.85	1.87	1.82	-0.01	0.48
Portugal	1.23	1.17	1.18	1.22	0.00	0.02
Poland	1.14	1.20	1.19	1.16	0.01	0.12
Denmark	0.98	1.03	1.02	1.01	0.01	0.59
Belgium	0.68	0.68	0.73	0.76	0.03	17.89
Finland	1.25	1.35	1.34	1.36	0.03	3.97
Italy	0.89	0.93	0.98	1.01	0.04	240.14
Ireland	1.04	1.23	1.21	1.20	0.05	1.70
Korea	0.80	0.94	0.97	0.99	0.06	8.78
Total	1.38	1.20	1.09	1.03	-0.116	37.17
Average	1.26	1.17	1.13	1.11	-0.049	18.91

1. "In your school, how much is learning of 15-year-old students hindered by lack of computers for instruction?" [SC11e]

2. The table shows the mean values of an index constructed from principals' responses, in which "Not at all" = 0, "Very little" = 1, "To some extent" = 2, "A lot" = 3.

F_{.05}=19.25; F_{.01}=99.25

Table 5.1: Frequency of computer availability in the home by mean score on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
Liechtenstein	506.59	403.54	449.2	325.44	423.52	24.424	1.54
Switzerland	512.61	471.39	467.97	428.53	428.63	21.082	28.11
Belgium	540.36	481.14	475.79	448	462.57	18.872	7.54
Denmark	514.57	459.02	458.41	447.75	446.97	14.647	6.35
Germany	509.93	484.73	465.12	466.77	447.5	14.282	31.15
United States	529.79	443.72	426.61	438.18	461.27	14.258	1.30
Australia	537.92	504.33	472.62	493.91	473.37	13.952	6.20
Brazil	447.81	380.07	367.51	375.82	390.41	11.905	1.57
Luxembourg	471.85	428.5	420.73	412.4	421.13	11.754	4.9
Hungary	511.26	488.35	489.33	483.61	456.47	11.432	17.40
Mexico	473.51	395.29	364.97	406.28	414.27	10.749	0.67
United Kingdom	544.38	475.63	435.71	490.18	485.98	10.225	0.62
New Zealand	550.63	468.01	489.42	502.26	482.43	10.215	1.06
Canada	545.41	492.76	490.87	503.79	491.54	9.671	2.28
Czech Republic	520.89	493.9	500.41	483.96	483.71	8.43	9.39
Sweden	522.06	480.72	471.93	499.16	471.94	8.18	1.70
Russian Federation	496.58	442.89	450.51	438.43	464.32	6.898	0.83
Finland	557.52	516.73	510.48	521.35	526.43	5.756	0.98
Ireland	541.69	496.99	525.53	518.84	508.24	4.505	0.64
Latvia	474.47	445.65	431.82	452	462.25	1.809	0.10
Total	525.45	456.99	441.34	452.87	441.27	17.248	4.45
Average	526.44	473.03	468.41	467.41	461.45	13.56	5.51

"How often is there a computer available for you to use at home?" [IT1a]
 $F_{.05}=9.01$; $F_{.01}=28.24$

Table 5.2 Frequency of computer use in the home by mean student performance on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
United States	530.24	518.31	507.42	469.23	457.41	-19.47	53.51
Switzerland	509.42	504.93	509.70	485.92	431.86	-17.41	6.79
Mexico	478.08	465.66	414.47	426.66	411.97	-17.12	11.13
Australia	538.77	539.91	531.33	503.55	471.39	-17.11	16.36
Liechtenstein	494.65	484.45	516.61	480.02	417.56	-15.86	2.56
Belgium	526.46	534.73	541.08	514.01	459.20	-15.52	3.79
New Zealand	541.73	550.52	549.25	516.53	488.21	-14.10	6.90
Canada	545.41	541.24	540.75	515.07	490.89	-13.52	15.75
United Kingdom	539.63	541.01	537.47	516.73	486.12	-13.13	10.80
Denmark	508.82	507.80	507.62	495.15	453.15	-12.40	6.34
Brazil	448.11	412.48	443.87	410.64	389.28	-11.95	4.22
Sweden	521.24	521.61	520.87	496.98	474.46	-11.82	11.30
Germany	501.78	512.63	510.20	508.58	446.80	-11.40	2.18
Norway	509.91	520.46	516.26	497.80	466.15	-11.02	5.24
Hungary	503.10	513.78	513.59	508.09	455.50	-10.09	2.17
Russian Federation	493.66	482.88	464.73	457.17	464.14	-8.48	10.64
Luxembourg	463.63	459.56	464.88	453.43	429.30	-7.48	5.73
Czech Republic	512.24	523.05	527.15	513.67	483.47	-6.69	1.86
Ireland	535.35	542.52	542.80	528.61	509.65	-6.53	3.96
Finland	552.83	557.69	553.44	552.54	525.88	-5.91	3.41
Latvia	464.77	487.93	438.64	471.19	462.32	-2.16	0.12
Total	524.23	517.87	509.95	486.26	439.01	-20.20	16.81
Average	520.03	523.40	520.21	502.66	461.48	-13.78	7.18

"How often do you use a computer at home?" [IT4a]
 $F_{.05}=9.01$; $F_{.01}=28.24$

Table 5.3: Availability of educational software in the home by level of proficiency on the combined reading literacy scale

	Level 1 and below	Level 2	Level 3	Levels 4 and 5	SLOPE	F
Finland	5.66	14.13	29.65	50.56	15.02	58.12
Korea	3.39	16.12	39.22	41.27	13.67	24.01
Canada	8.00	16.62	27.99	47.38	12.95	55.20
Netherlands	8.74	16.27	30.08	44.91	12.23	101.74
New Zealand	10.74	15.86	24.90	48.50	12.23	16.44
Japan	8.58	16.51	30.96	43.94	12.05	151.84
Ireland	9.40	16.40	28.87	45.33	12.03	64.33
Belgium	12.04	14.88	27.95	45.12	11.23	23.70
Australia	10.75	18.31	26.06	44.89	11.02	32.21
United Kingdom	10.54	18.50	27.27	43.69	10.82	57.89
France	9.84	19.30	31.83	39.02	10.01	207.56
Sweden	11.94	20.44	31.02	36.60	8.46	154.17
United States	14.11	19.25	28.70	37.94	8.09	125.41
Hungary	11.65	20.66	33.65	34.04	8.02	19.88
Norway	14.78	18.20	29.69	37.33	7.91	54.20
Austria	12.64	20.56	31.81	35.00	7.83	50.79
Iceland	12.40	20.85	32.24	34.51	7.77	35.91
Czech Republic	12.05	21.93	33.37	32.64	7.32	14.27
Spain	11.79	23.12	34.03	31.05	6.87	7.83
Poland	17.17	19.40	30.33	33.10	5.87	24.14
Greece	16.17	21.54	30.93	31.36	5.50	20.80
Portugal	15.94	21.66	31.56	30.84	5.46	13.98
Russian Federation	15.59	23.63	31.17	29.62	4.96	9.23
Denmark	17.03	22.56	29.74	30.68	4.81	27.64
Italy	15.85	24.08	31.60	28.46	4.53	5.52
Switzerland	18.75	21.18	29.36	30.70	4.40	23.58
Germany	19.25	22.16	27.90	30.69	4.01	95.87
Liechtenstein	22.15	21.81	28.28	27.75	2.33	5.67
Mexico	20.26	29.33	33.52	16.88	-0.60	0.02
Latvia	28.49	21.00	28.00	22.50	-1.10	0.32
Luxembourg	28.78	27.77	27.95	15.50	-3.97	3.72
Brazil	33.12	32.78	23.29	10.81	-7.64	15.07
Total	12.94	19.62	29.97	37.47	8.39	307.20
Average	13.00	19.67	30.07	37.27	8.32	280.15

"In your home, do you have educational software?" (% yes) [IT22d]

F_{.05}=19.25; F_{.01}=99.25

Table 5.4: Availability of an Internet link in the home by level of proficiency on the combined reading literacy scale

	Level 1 and below	Level 2	Level 3	Levels 4 and 5	Slope	F
Finland	5.09	11.97	27.84	55.10	16.59	26.43
Netherlands	6.98	14.89	28.02	50.11	14.25	39.85
Ireland	6.75	14.93	28.71	49.62	14.24	49.90
Japan	6.48	14.45	31.90	47.17	13.95	96.75
Canada	7.46	15.76	27.37	49.41	13.75	37.99
New Zealand	9.18	14.93	24.35	51.54	13.65	14.92
Belgium	10.07	13.19	26.19	50.55	13.44	16.10
Korea	3.94	16.34	38.56	41.17	13.39	26.66
France	8.25	15.21	29.62	46.92	13.04	61.25
United Kingdom	8.53	16.58	26.47	48.42	12.96	31.36
Australia	9.10	16.57	25.08	49.24	12.89	20.70
Austria	10.48	18.42	30.60	40.49	10.22	338.89
United States	11.64	18.11	29.10	41.15	9.95	118.15
Sweden	10.69	19.15	30.93	39.23	9.74	409.19
Spain	10.22	20.27	32.66	36.85	9.23	60.23
Switzerland	12.50	18.77	29.76	38.97	9.04	191.23
Czech Republic	11.61	20.36	29.30	38.73	9.03	6789.42
Portugal	14.11	18.79	30.45	36.65	7.93	75.59
Norway	15.30	18.28	28.12	38.30	7.88	41.20
Hungary	13.61	19.98	30.31	36.10	7.78	163.74
Germany	15.67	19.07	27.74	37.51	7.42	49.98
Iceland	13.21	21.05	31.64	34.11	7.33	40.95
Liechtenstein	14.56	19.49	32.63	33.32	6.94	18.65
Denmark	14.88	21.62	29.95	33.55	6.43	92.77
Italy	14.89	21.74	31.16	32.21	6.14	26.17
Poland	22.12	18.45	27.70	31.72	3.81	4.63
Greece	21.24	22.71	28.86	27.19	2.40	5.60
Russian Federation	20.60	24.39	27.97	27.05	2.29	8.13
Mexico	21.44	27.98	31.86	18.71	-0.43	0.02
Luxembourg	23.39	27.73	30.84	18.04	-1.29	0.20
Latvia	30.16	19.61	27.84	22.40	-1.51	0.38
Brazil	31.98	30.98	23.94	13.11	-6.37	16.60
Total	10.71	17.64	29.75	41.89	10.57	137.60
Average	11.45	18.14	29.37	41.04	10.00	142.03

"In your home, do you have a link to the Internet?" (% yes) [ST21d]

F_{.05}=19.25; F_{.01}=99.25

Table 5.5: Average number of computers in the home by level of proficiency on the combined reading literacy scale

	Level 1 and below	Level 2	Level 3	Levels 4 & 5	Slope	F
United States	0.84	1.06	1.29	1.56	0.24	852.55
Brazil	0.14	0.30	0.49	0.81	0.22	70.14
Mexico	0.12	0.28	0.51	0.76	0.22	215.00
Portugal	0.45	0.60	0.83	1.05	0.20	252.82
Luxembourg	1.03	1.30	1.47	1.62	0.19	96.01
Hungary	0.31	0.54	0.69	0.89	0.19	333.84
Belgium	0.89	1.09	1.25	1.44	0.18	1,213.37
France	0.53	0.66	0.85	1.04	0.17	273.93
Switzerland	1.02	1.26	1.43	1.53	0.17	58.98
Germany	1.05	1.29	1.38	1.56	0.16	69.43
Spain	0.57	0.71	0.86	1.05	0.16	377.33
New Zealand	0.85	0.95	1.09	1.26	0.14	152.59
Australia	1.15	1.26	1.39	1.56	0.14	201.04
Czech Republic	0.45	0.56	0.69	0.86	0.14	201.04
Austria	0.97	1.19	1.31	1.38	0.14	31.70
Sweden	1.30	1.48	1.58	1.71	0.13	143.81
Canada	1.05	1.15	1.26	1.44	0.13	92.04
Japan	0.76	0.89	0.98	1.10	0.11	456.33
Liechtenstein	1.17	1.29	1.47	1.48	0.11	21.73
Denmark	1.39	1.49	1.56	1.72	0.11	69.36
Finland	0.90	1.03	1.12	1.21	0.10	216.75
Korea	0.76	0.90	0.99	1.05	0.10	56.89
Greece	0.42	0.48	0.56	0.69	0.09	62.37
Poland	0.44	0.45	0.54	0.68	0.08	15.37
Italy	0.74	0.81	0.88	0.98	0.08	231.15
Russian Federation	0.15	0.17	0.21	0.32	0.06	14.07
Norway	1.46	1.48	1.53	1.62	0.05	22.84
Ireland	0.72	0.78	0.76	0.90	0.05	6.04
Netherlands	1.53	1.65	1.58	1.71	0.05	2.90
Latvia	0.30	0.25	0.32	0.36	0.03	1.98
United Kingdom	1.55	1.50	1.48	1.56	0.00	0.00
Iceland	1.56	1.52	1.56	1.55	0.00	0.01
Total	0.68	0.89	1.07	1.30	0.20	990.86
Average	0.79	0.96	1.11	1.29	0.17	1,815.00

F_{.05}=19.25; F_{.01}=99.25

Table 6: Index of interest in computers (mean index), by level of proficiency on the combined reading literacy scale

	Level 1 and below	Level 2	Level 3	Levels 4 and 5	Slope	F
Finland	-0.01	-0.04	-0.07	-0.24	-0.07	8.82
New Zealand	-0.19	-0.24	-0.22	-0.34	-0.04	5.39
Hungary	-0.06	0.09	0.04	-0.17	-0.04	0.44
Denmark	-0.20	-0.17	-0.24	-0.29	-0.03	4.98
United Kingdom	0.18	0.19	0.19	0.08	-0.03	2.20
Sweden	0.08	0.15	0.08	0.01	-0.03	1.33
Liechtenstein	0.26	0.12	0.18	0.15	-0.03	1.01
Germany	0.23	0.31	0.29	0.16	-0.02	0.48
Australia	-0.20	-0.15	-0.18	-0.26	-0.02	1.03
Switzerland	0.01	0.17	0.13	-0.03	-0.02	0.10
Luxembourg	0.24	0.33	0.31	0.25	0.00	0.00
Belgium	-0.09	0.06	0.05	-0.03	0.02	0.21
Canada	-0.16	-0.09	-0.06	-0.09	0.02	2.29
Czech Republic	-0.18	0.00	0.06	-0.10	0.03	0.31
Latvia	0.17	0.38	0.39	0.31	0.04	0.85
Ireland	-0.13	0.00	0.03	0.01	0.05	3.52
Brazil	0.27	0.44	0.48	0.42	0.05	1.81
Mexico	0.04	0.40	0.48	0.47	0.14	5.21
United States	-0.15	0.23	0.42	0.44	0.20	11.85
Russian Federation	-0.23	0.21	0.36	0.47	0.23	16.68
Total	-0.02	0.21	0.28	0.22	0.08	2.96
Average	-0.02	0.08	0.05	-0.08	-0.02	0.33

All results are standardised to an OECD-wide mean of 0.0 and a standard deviation of 1.0.
 $F_{.05}=19.25$; $F_{.01}=99.25$

Table 7: Index of perceived comfort with and ability to use computers by achievement level on the combined reading literacy scale

	Level 1 and below	Level 2	Level 3	Levels 4 and 5	Slope	F
Luxembourg	-0.02	-0.09	-0.13	-0.15	-0.04	29.35
Germany	-0.31	-0.30	-0.28	-0.32	0.00	0.01
Norway	0.03	-0.06	-0.02	0.02	0.00	0.00
Latvia	-0.28	-0.23	-0.16	-0.16	0.04	17.95
Sweden	-0.20	-0.13	-0.06	-0.06	0.05	16.33
Finland	-0.29	-0.19	-0.11	-0.09	0.07	27.52
Liechtenstein	-0.30	-0.39	-0.25	-0.12	0.07	3.09
Belgium	-0.02	0.14	0.15	0.21	0.07	10.89
Denmark	-0.17	-0.14	-0.06	0.08	0.08	22.74
Hungary	-0.52	-0.36	-0.27	-0.25	0.09	16.53
Switzerland	-0.45	-0.28	-0.21	-0.16	0.09	22.54
Russian Federation	-0.46	-0.33	-0.28	-0.12	0.11	56.40
Ireland	-0.39	-0.28	-0.17	0.02	0.13	93.52
Canada	0.19	0.36	0.49	0.61	0.14	288.37
New Zealand	-0.06	0.10	0.27	0.36	0.14	125.45
Czech Republic	-0.56	-0.41	-0.28	-0.12	0.15	1,401.67
United Kingdom	0.04	0.27	0.40	0.51	0.15	60.50
Australia	0.12	0.26	0.46	0.59	0.16	297.94
United States	0.24	0.49	0.67	0.80	0.19	95.57
Mexico	-0.39	-0.22	0.11	0.29	0.24	116.29
Brazil	-0.70	-0.41	-0.13	0.39	0.36	77.08
Total	-0.11	0.12	0.34	0.48	0.20	174.45
Average	-0.21	-0.09	0.02	0.14	0.12	6,728.00

All results are standardised to an OECD-wide mean of 0.0 and a standard deviation of 1.0.
 $F_{.05}=19.25$; $F_{.01}=99.25$

Table 8.1 Index of computer usage (mean), by level of proficiency on the combined reading literacy scale

	Level 1 and below	Level 2	Level 3	Levels 4 and 5	Slope	F
New Zealand	0.41	0.39	0.29	0.10	-0.10	14.67
Norway	0.08	-0.18	-0.19	-0.22	-0.09	4.91
Sweden	0.14	0.11	0.02	-0.12	-0.09	24.98
Luxembourg	0.28	0.12	0.08	0.03	-0.08	16.13
United States	0.47	0.51	0.43	0.27	-0.07	4.59
Denmark	0.19	0.10	0.05	0.00	-0.06	80.08
Finland	-0.08	-0.10	-0.18	-0.24	-0.06	43.56
United Kingdom	0.43	0.41	0.40	0.28	-0.05	6.57
Germany	0.06	0.14	0.14	-0.05	-0.03	0.58
Belgium	-0.08	-0.06	-0.06	-0.18	-0.03	1.67
Ireland	0.03	0.00	0.00	-0.02	-0.02	15.00
Australia	0.25	0.31	0.29	0.21	-0.01	0.40
Canada	0.06	0.00	0.01	0.02	-0.01	0.82
Liechtenstein	-0.24	-0.21	-0.10	-0.28	0.00	0.00
Switzerland	-0.26	-0.21	-0.19	-0.25	0.00	0.08
Latvia	-0.22	-0.23	-0.07	-0.12	0.05	2.78
Hungary	-0.23	0.03	0.07	0.02	0.08	2.51
Czech Republic	-0.56	-0.33	-0.17	-0.13	0.15	22.98
Brazil	-0.31	0.10	0.11	0.26	0.17	9.40
Russian Federation	-1.02	-0.67	-0.36	-0.09	0.31	600.63
Mexico	-0.70	-0.05	0.30	0.46	0.38	24.19
Total	-0.04	0.23	0.26	0.15	0.06	0.98
Average	-0.04	0.04	0.04	-0.03	0.00	0.02

All results are standardised to an OECD-wide mean of 0.0 and a standard deviation of 1.0.
 $F_{.05}=19.25$; $F_{.01}=99.25$

Table 8.2 Frequency of Internet use¹ by mean student performance on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
United States	524.80	532.03	520.35	502.97	426.00	-22.67	6.44
Mexico	478.99	473.66	464.07	458.02	415.35	-14.29	12.28
Australia	537.93	539.16	537.85	512.54	483.21	-13.61	10.24
Norway	513.48	510.95	523.35	506.09	448.18	-13.55	3.18
Hungary	505.89	505.55	508.91	494.83	445.22	-13.21	4.69
Switzerland	520.67	514.76	508.84	486.18	469.30	-13.13	39.13
Sweden	518.57	520.45	526.95	512.899	464.03	-11.65	3.33
Czech Republic	523.03	532.59	536.49	511.69	477.04	-11.29	3.80
Brazil	444.22	440.37	427.19	429.77	395.30	-10.84	11.33
Finland	556.85	546.87	553.42	552.17	501.04	-10.63	3.31
Canada	541.94	536.95	538.17	520.59	498.12	-10.40	13.50
Denmark	502.92	501.72	517.04	504.60	454.18	-9.46	1.85
New Zealand	541.37	540.51	553.18	528.31	502.86	-8.92	3.58
Liechtenstein	492.40	482.01	491.05	492.29	449.84	-7.48	2.19
Germany	513.91	513.01	514.84	505.38	481.00	-7.35	5.88
United Kingdom	538.26	542.13	540.79	537.52	503.96	-7.32	3.23
Belgium	529.55	535.04	546.90	533.53	496.39	-6.78	1.41
Luxembourg	463.56	460.61	472.37	457.65	431.34	-6.74	2.74
Ireland	549.97	537.64	552.44	537.07	520.49	-5.95	3.62
Russian Federation	455.18	500.40	510.67	498.61	475.13	3.81	0.23
Latvia	447.37	474.89	493.55	488.39	461.49	4.17	0.41
Total	524.65	524.85	518.44	502.27	449.96	-17.20	8.56
Average	523.47	521.48	526.10	510.01	470.67	-11.71	5.50

1. "How often do you use the Internet?" [IT5a]

F_{.05}=9.01; F_{.01}=28.24

Table 8.3: Frequency of use of computers for electronic communication¹ by mean student performance on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
United States	529.91	528.66	516.44	522.54	466.41	-13.31	5.15
Mexico	476.63	475.31	455.96	453.13	424.29	-12.69	24.48
Czech Republic	530.40	533.73	536.18	507.09	488.37	-11.07	7.40
Switzerland	524.31	517.98	512.65	503.36	477.50	-10.82	21.44
Hungary	510.75	509.40	507.98	499.66	464.62	-10.20	6.68
Liechtenstein	511.07	485.04	491.70	480.43	466.92	-9.29	13.74
Brazil	446.63	434.14	429.82	433.88	403.10	-8.73	8.51
Australia	537.77	541.43	538.92	537.68	498.30	-8.27	3.17
Canada	545.93	540.78	537.62	529.53	511.12	-8.09	22.86
Finland	562.90	550.34	551.68	551.94	523.89	-7.64	6.91
Sweden	522.09	517.42	532.52	521.30	482.86	-7.46	1.90
United Kingdom	549.43	540.07	541.03	537.95	515.04	-7.09	9.41
New Zealand	550.16	539.41	545.97	543.05	514.44	-6.78	4.15
Norway	514.48	513.35	519.45	525.56	475.86	-6.50	1.15
Belgium	540.89	534.55	542.74	539.99	506.87	-6.26	2.35
Denmark	507.63	505.20	516.51	512.40	474.74	-5.86	1.37
Ireland	553.16	542.69	551.30	544.18	525.56	-5.37	4.59
Germany	512.54	512.63	516.55	518.18	486.41	-4.67	1.43
Luxembourg	468.70	459.45	467.48	461.57	447.56	-4.02	3.92
Latvia	478.09	466.13	465.25	483.21	469.92	0.07	0.00
Russian Federation	472.42	472.82	476.09	499.65	478.39	3.88	1.24
Total	528.45	523.83	516.56	515.85	467.98	-12.89	7.01
Average	527.01	522.61	525.26	520.68	485.65	-8.47	4.51

1. "How often do you use a computer for electronic communication?" [IT5b]

F_{.05}=9.01; F_{.01}=28.24

Table 8.4: Frequency with which computers are used for learning school material¹ by mean student performance on the combined reading literacy scale [IT5C]

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
Mexico	449.50	458.69	449.60	436.71	403.48	-11.40	6.78
Russian Federation	489.84	488.55	488.89	470.55	451.78	-9.41	11.70
Denmark	499.36	507.81	513.85	497.28	462.06	-8.51	2.42
United Kingdom	520.16	538.20	551.60	530.79	486.07	-7.56	0.91
Australia	518.94	542.83	537.35	537.67	503.33	-3.64	0.41
Brazil	404.59	429.30	440.48	426.36	401.71	-0.87	0.02
Hungary	478.17	494.46	507.52	510.39	467.39	-0.56	0.01
Canada	522.83	537.68	548.42	541.13	520.92	-0.04	0.00
Liechtenstein	494.80	469.17	489.83	496.31	486.93	1.14	0.08
United States	494.30	519.26	540.51	541.27	489.58	1.26	0.02
Finland	526.04	544.49	560.17	562.83	529.19	2.46	0.17
Czech Republic	484.48	507.66	523.74	520.89	493.12	3.05	0.26
Sweden	496.78	518.07	531.19	526.66	508.34	3.17	0.45
New Zealand	503.03	537.25	556.51	546.18	527.60	5.81	0.76
Luxembourg	428.98	458.04	477.33	475.38	450.72	6.08	0.92
Norway	469.04	506.66	530.75	520.52	495.37	6.65	0.72
Latvia	435.35	471.79	483.85	473.09	469.66	6.99	1.70
Germany	467.02	494.66	520.24	518.44	490.24	7.02	1.02
Ireland	496.60	529.14	547.85	546.03	537.91	9.95	3.95
Switzerland	454.64	487.61	513.44	514.42	503.85	12.52	5.17
Belgium	469.47	506.42	538.71	541.68	527.39	15.11	5.37
Total	488.11	508.34	529.53	526.35	485.09	1.20	0.03
Average	487.94	511.65	529.29	526.89	499.50	3.84	0.40

1. How often do you use the computer to help you learn school material?" [IT5C]

F_{.05}=9.01; F_{.01}=28.24

Table 8.5: Frequency with which computers are used for programming¹ by mean student performance on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
Russian Federation	466.79	489.22	490.11	484.67	472.89	0.77	0.04
Mexico	426.36	446.34	458.29	457.31	434.96	2.82	0.34
Liechtenstein	479.63	462.00	468.28	482.17	503.31	6.75	2.49
Hungary	479.68	469.92	470.31	498.48	503.44	7.61	4.21
Canada	515.89	525.93	530.25	543.41	546.44	7.86	92.98
Brazil	406.26	405.42	418.01	435.83	432.65	8.32	16.85
Czech Republic	475.26	496.86	509.65	510.24	511.42	8.57	10.32
Latvia	432.58	441.86	465.42	467.24	484.41	12.90	63.22
United States	487.22	510.75	513.26	532.93	540.72	12.92	57.18
Luxembourg	431.70	431.83	460.26	474.68	475.62	13.07	24.20
Ireland	493.77	515.28	539.18	543.03	549.65	13.95	28.26
United Kingdom	491.10	516.91	529.50	547.70	546.90	14.24	31.65
Australia	492.04	516.46	527.40	541.09	552.09	14.47	105.08
Denmark	465.53	477.80	490.04	516.12	521.43	15.01	88.27
Sweden	481.34	490.38	510.13	523.15	540.76	15.16	295.92
Finland	505.05	524.41	532.13	552.88	566.67	15.17	223.18
Switzerland	459.72	472.92	492.00	507.75	518.24	15.19	371.29
Belgium	476.00	502.51	524.26	535.33	539.59	16.00	35.02
Germany	452.89	484.23	487.47	517.28	522.26	17.18	42.03
New Zealand	483.64	517.64	532.01	548.55	561.24	18.61	67.99
Norway	445.58	474.39	488.77	523.70	528.11	21.44	73.07
Total	478.06	495.34	505.16	523.93	524.91	12.23	58.10
Average	473.64	492.92	507.44	524.28	528.94	14.20	94.58

1. "How often do you use the computer for programming?" [IT5d]
 $F_{.05}=9.01$; $F_{.01}=28.24$

Table 8.6: Frequency with which computers are used for games¹ by mean student performance on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
Brazil	419.67	427.91	433.65	430.84	390.14	5.61	1.00
Russian Federation	476.18	482.66	481.46	487.31	461.23	2.53	0.56
Hungary	485.21	489.29	502.60	509.51	464.00	2.22	0.12
Mexico	429.22	453.91	452.87	460.86	420.42	1.07	0.03
United States	496.22	528.85	537.24	543.85	496.10	-1.48	0.03
Denmark	494.61	502.68	508.85	522.11	497.70	-2.56	0.48
Latvia	454.71	469.09	482.97	488.30	462.20	-3.42	0.52
Canada	521.72	533.81	546.76	548.56	532.04	-3.54	1.01
Norway	494.13	511.25	533.42	531.99	508.85	-5.02	0.88
Germany	481.28	502.05	520.24	533.58	491.71	-5.24	0.54
Luxembourg	443.28	456.36	476.81	480.87	458.65	-5.53	1.39
Switzerland	485.55	494.60	515.53	518.86	501.92	-5.70	2.12
Finland	536.06	547.67	557.72	571.70	553.42	-5.88	3.03
Belgium	493.15	528.92	544.28	549.27	512.48	-5.90	0.58
Czech Republic	489.82	506.32	516.01	516.06	517.23	-6.46	10.01
United Kingdom	510.58	535.15	553.90	565.20	533.59	-7.61	1.47
Sweden	500.78	517.29	530.69	544.05	526.68	-7.86	4.40
Ireland	509.03	537.62	553.84	556.40	544.77	-9.03	3.86
Australia	504.20	526.06	543.15	549.27	539.62	-9.40	6.58
Liechtenstein	455.39	479.76	501.86	492.94	500.82	-10.40	7.87
New Zealand	506.83	530.83	550.85	562.96	547.70	-11.39	6.57
Total	492.15	513.95	525.32	533.54	484.30	-0.389	0.00
Average	495.79	512.86	527.45	535.71	505.41	-4.209	0.61

1. "How often do you use games?" [IT6a]

F_{.05}=9.01; F_{.01}=28.24

Table 8.7: Frequency with which computers are used for word processing¹ by mean student performance on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
United States	513.80	530.88	539.45	490.75	420.80	22.61	3.89
Denmark	505.52	513.80	508.59	473.40	423.27	20.49	8.11
Australia	531.53	541.24	542.02	493.34	453.65	20.37	7.14
Liechtenstein	529.71	484.33	503.75	461.01	449.12	18.45	12.64
Mexico	478.16	465.79	450.50	444.98	396.95	18.32	20.65
Belgium	508.42	532.31	555.30	521.25	437.11	15.37	1.26
Canada	533.76	547.14	547.40	516.82	474.18	14.95	4.54
Sweden	513.27	523.92	534.87	510.03	450.79	13.88	2.47
Brazil	442.89	432.72	431.90	425.28	380.42	13.24	8.29
Hungary	495.88	497.10	504.96	495.20	430.83	13.20	2.67
Switzerland	489.56	518.93	520.55	501.76	437.47	12.14	1.41
New Zealand	521.05	545.98	564.96	525.16	471.51	11.99	1.24
Czech Republic	512.54	522.80	531.48	507.64	461.16	11.79	2.62
United Kingdom	525.27	537.93	551.91	517.56	477.36	11.62	2.22
Russian Federation	507.86	496.32	502.39	497.06	455.80	10.34	4.97
Germany	491.43	510.29	520.54	513.82	446.15	8.70	0.79
Finland	545.16	552.86	557.73	557.16	504.42	7.72	1.27
Norway	493.44	525.65	530.92	503.37	469.80	6.96	0.73
Ireland	525.97	546.73	554.44	539.62	496.75	6.56	0.79
Luxembourg	455.63	467.52	475.99	459.27	428.17	6.32	1.32
Latvia	460.63	482.42	490.41	475.60	439.03	5.00	0.54
Total	509.44	522.09	531.61	497.51	426.22	19.10	3.27
Average	508.26	523.70	532.73	510.35	450.19	12.95	2.02

1. "How often do you use word processing?" [IT6b]
 $F_{.05}=9.01$; $F_{.01}=28.24$

Table 8.8: Frequency with which computers are used for spreadsheets¹ by mean student performance on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
Mexico	445.35	461.38	461.05	456.15	418.68	5.857	1.10
Brazil	426.41	416.57	440.17	442.24	406.77	1.361	0.06
Russian Federation	476.32	494.04	499.72	502.24	469.88	0.468	0.01
Hungary	476.36	492.18	503.47	506.90	472.98	-0.796	0.02
Czech Republic	489.34	507.95	521.97	519.62	492.25	-1.749	0.10
Switzerland	466.63	504.12	517.41	526.07	480.10	-4.889	0.32
Latvia	428.67	481.93	490.23	487.08	451.25	-5.031	0.29
Liechtenstein	468.74	465.62	492.61	506.83	477.73	-5.919	1.25
Ireland	502.11	531.52	548.73	551.45	532.59	-8.089	2.21
Luxembourg	431.71	452.41	475.09	479.98	460.25	-8.465	2.80
Canada	504.71	521.57	543.66	550.39	533.53	-8.646	3.90
Belgium	483.21	517.69	545.18	552.66	510.59	-8.973	1.04
Australia	501.84	517.90	536.64	552.09	529.99	-9.049	3.92
Denmark	470.54	488.84	506.70	516.50	505.83	-9.824	8.23
Germany	460.40	491.97	507.89	527.04	499.46	-11.319	3.46
United States	479.32	506.53	524.56	547.88	519.07	-12.085	4.09
Sweden	480.53	493.70	518.52	530.07	525.76	-12.683	19.38
New Zealand	493.87	511.71	558.40	560.04	534.08	-12.875	2.93
Finland	492.00	531.44	545.28	561.47	553.94	-15.391	11.08
United Kingdom	482.70	512.12	542.24	554.05	538.99	-15.451	7.96
Norway	444.95	496.16	519.04	530.98	510.96	-16.684	4.90
Total	475.42	498.65	519.24	537.18	500.97	-8.963	1.77
Average	475.36	501.74	524.16	534.90	508.02	-9.848	2.61

1. "How often do you use spreadsheets?" [IT6c]

F_{.05}=9.01; F_{.01}=28.24

Table 8.9: Frequency with which computers are used for drawing, painting or graphics¹ by mean student performance on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
Mexico	441.43	454.00	452.28	450.91	421.17	4.36	1.03
Russian Federation	480.84	495.78	497.39	495.92	461.64	3.83	0.55
Liechtenstein	512.37	468.43	483.78	499.25	485.65	2.26	0.15
Hungary	482.60	486.77	501.71	504.09	462.74	2.24	0.14
Czech Republic	483.71	508.53	519.03	519.04	476.99	0.29	0.00
Brazil	414.97	412.30	437.28	435.43	413.02	-1.92	0.19
Australia	512.02	523.46	537.58	546.59	527.31	-5.37	2.08
Finland	532.01	541.06	550.85	558.03	552.79	-5.85	11.76
Ireland	508.40	532.48	548.82	549.23	530.39	-6.07	1.47
Germany	468.85	496.23	517.17	527.05	484.07	-6.13	0.60
Canada	509.87	529.82	542.75	549.99	531.14	-6.27	2.19
United Kingdom	508.88	520.21	547.54	556.97	524.49	-6.80	1.22
Norway	477.85	508.65	525.56	528.90	501.72	-6.80	1.13
Luxembourg	435.57	451.82	475.72	479.55	455.88	-6.83	1.66
Latvia	433.39	466.16	483.32	488.05	458.31	-7.17	1.11
Sweden	494.49	507.79	524.08	531.98	520.23	-7.57	5.81
Denmark	482.03	487.87	505.63	518.71	505.72	-7.82	6.73
Switzerland	464.13	498.19	509.39	524.75	491.23	-8.08	1.41
United States	479.30	516.79	534.65	539.90	521.40	-10.73	3.10
Belgium	467.20	510.23	534.24	551.00	523.44	-15.33	4.21
New Zealand	485.96	520.68	546.50	559.84	545.35	-15.79	8.17
Total	477.13	504.41	523.19	532.06	499.13	-7.17	1.15
Average	482.57	505.62	523.59	532.79	507.03	-7.61	1.92

1. How often do you use drawing, painting, graphics? [IT6d]
 $F_{.05}=9.01$; $F_{.01}=28.24$

Table 8.10: Frequency with which computers are used for educational software¹ by mean student performance on the combined reading literacy scale

	Almost every day	A few times each week	Between once a week and once a month	Less than once a month	Never	Slope	F
Russian Federation	474.15	485.65	493.99	490.73	459.43	2.44	0.24
Mexico	430.48	451.03	460.44	457.20	421.91	1.10	0.03
Hungary	475.53	478.65	502.05	504.13	482.68	-3.98	0.83
Brazil	397.64	415.57	442.28	431.37	419.49	-5.95	1.36
Ireland	507.28	529.02	551.91	548.80	527.60	-6.04	1.15
Czech Republic	474.42	499.36	513.52	519.22	501.01	-7.30	2.41
United States	480.52	508.94	536.68	541.46	507.10	-8.57	1.28
Canada	491.66	526.51	545.03	549.57	529.95	-9.96	2.74
United Kingdom	491.14	520.59	548.82	551.75	529.14	-10.72	2.73
Latvia	427.79	465.85	469.67	488.24	475.39	-11.76	6.18
Liechtenstein	432.57	497.31	467.65	481.91	502.14	-12.37	2.88
Australia	480.27	520.04	539.69	547.73	528.80	-12.48	3.89
Luxembourg	413.78	439.62	471.00	481.62	466.74	-14.79	7.73
Belgium	461.99	504.73	542.61	554.04	514.78	-15.49	2.57
Germany	436.69	494.03	507.58	523.80	504.07	-16.45	4.64
New Zealand	474.45	517.47	553.97	559.74	536.66	-16.67	4.26
Denmark	450.34	468.16	495.25	519.07	510.24	-17.07	21.41
Switzerland	438.24	479.26	508.22	517.92	508.04	-17.83	9.05
Finland	481.29	519.87	544.52	562.24	552.01	-18.38	12.49
Sweden	456.50	484.11	512.64	531.87	526.21	-18.72	22.00
Norway	414.12	477.05	509.76	528.62	516.84	-25.70	10.32
Total	467.25	496.94	524.58	532.67	500.91	-10.31	2.00
Average	459.94	496.75	523.00	533.42	511.83	-14.05	4.54

1. "How often do you use educational software?" [IT6e]
 $F_{.05}=9.01$; $F_{.01}=28.24$