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THE FINNISH SUCCESS IN PISA – AND SOME REASONS BEHIND IT 2

PISA 2003

OECD PISA

PISA IN A NUTSHELL

A three-year survey of the knowledge and skills of 15-year-olds in the principal industrialised countries

- The survey, conducted first in 2000, will be repeated every three years.
- In 2003, over 250,000 students from 41 countries took part.
- Students sat pencil and paper assessments in their schools.
- Students and their principals also answered questionnaires about themselves and their schools. This allowed PISA to identify what factors are associated with better performance.

A new way of looking at student performance

- PISA assessed young people's capacity to use their knowledge and skills in order to meet real-life challenges, rather than merely looking at how well they had mastered a specific school curriculum.
- PISA assessed literacy in three domains – reading, mathematics and science. In 2000, priority was given to reading literacy, with mathematical and scientific literacy assessed in lesser depth.
- Students had to understand key concepts, to master certain processes and to apply knowledge and skills in different authentic situations.
- Information was also collected on student attitudes and approaches to learning.

A unique collaboration between countries to monitor education outcomes

- PISA was co-ordinated by governments of participating countries, through the Organisation for Economic Co-operation and Development (OECD).
- Leading international experts worked to develop an assessment whose results are comparable across different national and cultural contexts.
- PISA improves international information on student outcomes, giving countries benchmarks and regular updates on how students perform against them.

The implementation of PISA in Finland

- In Finland, PISA was conducted by the Institute for Educational Research at the University of Jyväskylä. The project was co-ordinated by Professor Jouni Välijärvi and collaborated by Professor Pirjo Linnakylä, Researchers Pekka Kupari, Pasi Reinikainen, Antero Malin, Eija Puhakka, Viking Brunell, Kaisa Leino, Tiina Nevanpää, Sari Sulkunen and Jukka Törnroos, and Inga Arffman, Seija Haapaviita and Kirsi Häkämies.
- The Finnish PISA survey was funded by the Ministry of Education and the University of Jyväskylä.

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2

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FOREWORD

The outstanding success of Finnish students in PISA has been a great joy but at the same time a somewhat puzzling experience to all those responsible for and making decisions about education in Finland. At a single stroke, PISA has transformed our conceptions of the quality of the work done at our comprehensive school and of the foundations it has laid for Finland's future civilisation and development of knowledge. Traditionally, we have been used to thinking that the models for educational reforms have to be taken from abroad. This sudden change in role from a country following the example of others to one serving as a model for others reforming school has prompted us to recognise and think seriously about the special characteristics and strengths of our comprehensive school.

In this publication, we as the researchers responsible for the implementation of PISA 2003 in Finland, try to open up some perspectives on the possible reasons underlying the high performance of Finnish students in PISA. There is, in fact, no one single explanation for the result. Rather, the successful performance of Finnish students seems to be attributable to a web of interrelated factors having to do with comprehensive pedagogy, students' own interests and leisure activities, the structure of the education

system, teacher education, school practices and, in the end, Finnish culture. Perspectives on this web of explanations will be opened up not only by analysing the results of PISA but also by considering some characteristics of the Finnish education system and our cultural heritage which, both at and outside school, can be thought to have contributed to Finland's successful performance.

We hope this publication will raise questions and discussions as to how we can continue developing the school for the benefit of society and the young responsible for its future. Therefore, all comments, ideas and questions concerning the publication are welcome. The publication further aims at promoting mutual understanding of the diverse educational solutions found in various countries, which in turn, will hopefully help us to get a better picture of the special characteristics and future developmental possibilities of our own comprehensive school. A possible channel for discussion are the below-mentioned e-mail addresses of the authors.

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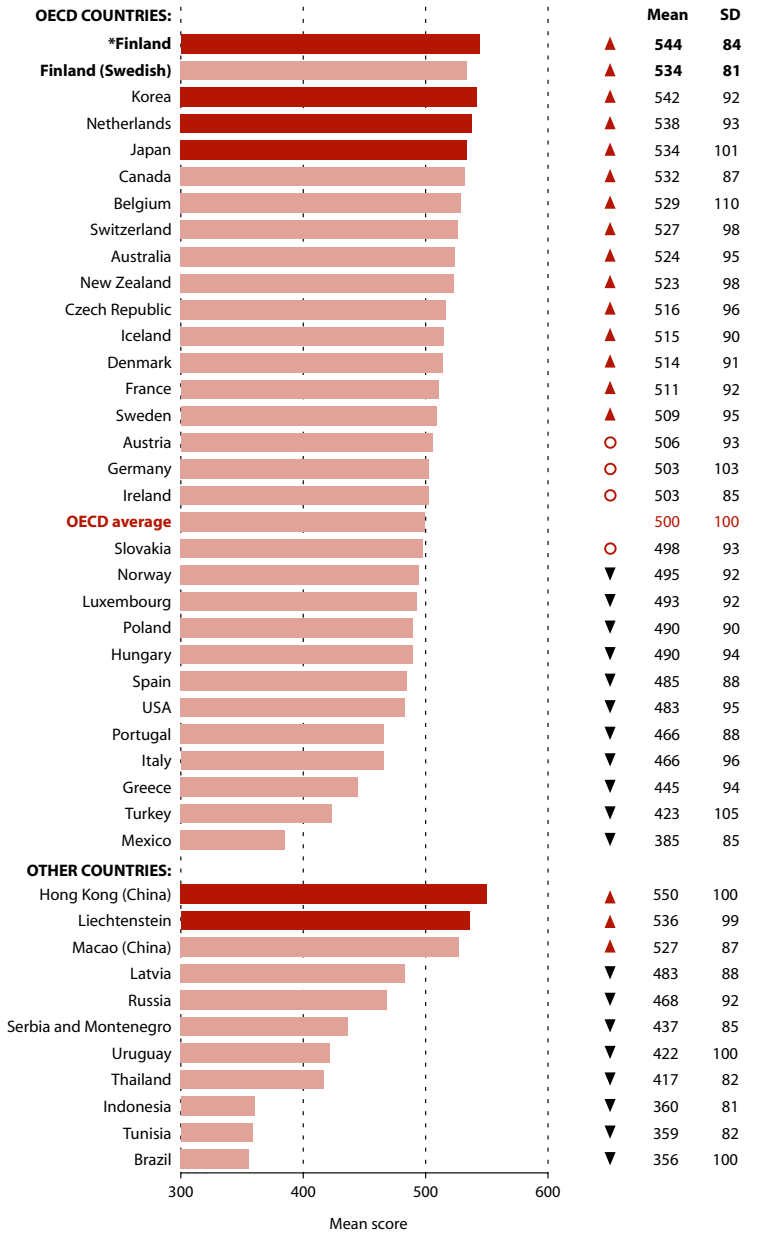
HIGH QUALITY OF EDUCATIONAL OUTCOMES

Finland on top of OECD in mathematical literacy

Based on the national mean scores of mathematical literacy among the countries participating in the PISA 2003 assessment (Figure 1), Finland showed the highest mathematical literacy performance in the OECD and the second highest performance within all countries. Three other OECD countries – Korea, the Netherlands and Japan – and two partner countries – Hong Kong/China and Liechtenstein – reached the same performance level as Finland; the rest 34 countries had a significantly lower mean score than Finland (544 points). The mean score of the Swedish-speaking Finnish students was high as well (534 points). The difference between the Finnish-speaking and Swedish-speaking students was not large but anyhow statistically significant. A comparatively high equality seems to be integral to the Finnish mathematical literacy performance since the standard deviation, which is an indicator of variation in student performance, was the smallest of all OECD countries.

Figure 1 **Mean scores for mathematical literacy**



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*Includes both Finnish-speaking and Swedish-speaking students

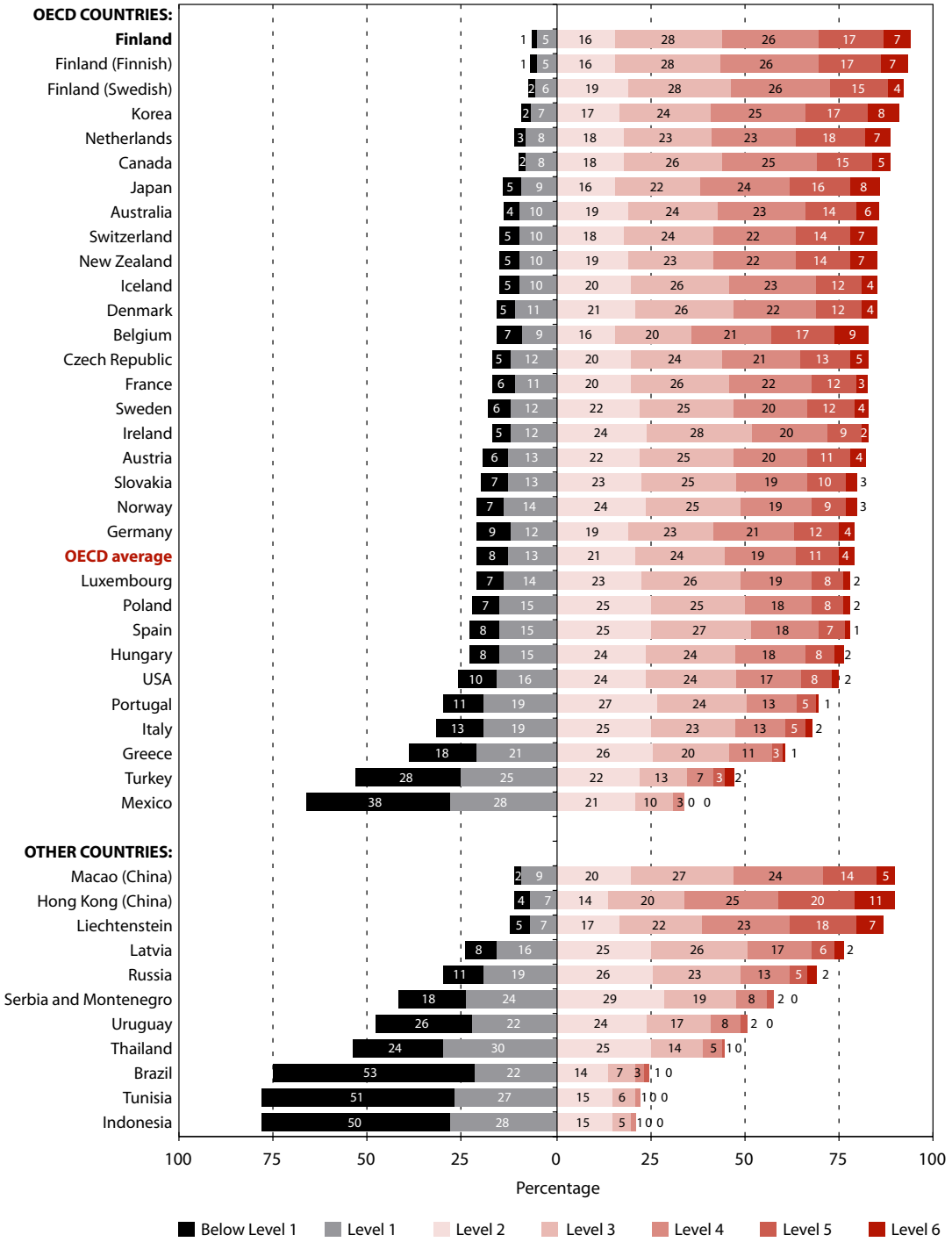
Finnish students' mathematical literacy performances were high level in all four content areas. In the light of the national mean scores, Finnish students scored highest (549 points) within all participating countries in the area of *quantity*. Only the students of Hong Kong/China reached the same level (545 points). In two content areas – *change and relationships* and *uncertainty* – Finland ranked third, but Finland's performance, however, was not significantly lower than that of the top countries of these areas – the Netherlands and Hong Kong/China. In the area of *space and shape*, Finland ranked fifth but only the performance of Hong Kong/China (558) was significantly higher than the result of Finland (539). In the light of these results Finnish students' performance in space and shape seems slightly weaker than in the three other content areas of mathematical literacy measured in PISA 2003.

To explore variation in student performance, students were distributed across six proficiency levels according to their mathematical literacy scores. Figure 2 shows the percentage of students at different proficiency levels in each participating country. The results reveal the great variation in mathematical literacy performance both between and within countries. In almost all countries, some students are found among the best performers in mathematical literacy, whilst there are also those whose performance remains at or below Level 1 (very large percentages in many partner countries).

Among the OECD countries, an average of 4 per cent of students reached the highest proficiency level, that is, Level 6 in mathematical literacy. In Finland, this level was attained by 7 per cent of students, which was the fourth highest percentage among all participating countries, with the partner country Hong Kong/China on top (11 per cent). Compared to Finland, higher or equal percentages of top performers were found in OECD countries Belgium (9 per cent), Korea (8 per cent), Japan (8 per cent), the Netherlands (7 per cent), Switzerland (7 per cent) and New Zealand (7 per cent).

Proficiency level 5, representing excellent mathematical performance, was reached by 17 per cent of Finnish students, which was clearly above the OECD

Figure 2 **Percentage of students at each level of proficiency on the mathematics scale**



average (11 per cent). Among OECD countries, only the Netherlands (18 per cent), Belgium (17 per cent) and Korea (17 per cent) and in the partner countries Hong Kong/China (20 per cent) and Liechtenstein (18 per cent) reached a higher or equal percentage compared to Finland.

The greatest proportion of Finnish students reached the proficiency levels 4 and 3, which indicated good (Level 4) and satisfactory (Level 3) mathematical performance. The percentage of Finnish students at Level 4 was 26 and it was the highest among all participating countries (the combined OECD area averaging 19 per cent). High percentages for this level were also achieved in OECD countries Canada, Korea, Japan, the Netherlands, Australia, and Iceland and in the partner countries Hong Kong/China, Macao/China and Liechtenstein. For Finland, this result means that a total of 50 per cent of students ranked among good performers (Levels 4–6), while the corresponding figure for the OECD was 34 per cent. Only Korea and Hong Kong/China achieved as high percentages as Finland.

Proficiency level 3 (satisfactory performance) was attained by 28 per cent of Finnish students, the OECD average being 24 per cent. In addition to Finland, 19 OECD countries and 2 partner countries exceeded the OECD average, and Ireland alone reached the same percentage as Finland.

The next proficiency level, Level 2, was achieved by 16 per cent of Finnish students and the percentage was one of the smallest among all participating countries and also clearly smaller than the corresponding OECD average (21 per cent). Small percentages were also found in OECD countries Belgium (16 per cent), Japan (16 per cent) and Korea (17 per cent) and in the partner countries Hong Kong/China (14 per cent) and Liechtenstein (17 per cent).

In Finland, 94 per cent of students reached at least Level 2, which represented a baseline level of mathematics proficiency in PISA 2003 (students begin to demonstrate the kind of literacy skills that enable them to actively use mathematics). The OECD average was 79 per cent. Six other countries

achieved about 90 per cent result: the OECD countries Canada, Korea and the Netherlands and the partner countries Hong Kong/China, Macao/China and Liechtenstein.

Finally, proficiency at or below Level 1, which means poor mathematical performance, was attained only by 6 per cent of Finnish students, the corresponding figure for the combined OECD area being 21 per cent. The percentage of Finland was the smallest among all participating countries. In the other well-performing countries, the percentage of students at or below Level 1 was about 10 per cent. Thus, the high Finnish performance on mathematical literacy was strongly based on the really small proportion of weak students compared to the other participating countries.

In the four content areas of mathematical literacy, the percentages of students at different proficiency levels were very equal, with differences remaining at 1 or 2 per cent points.

Some improvement in performance since PISA 2000

In PISA 2003, Finnish students' performance was slightly higher than in 2000 on those two content areas – *space and shape, change and relationships* – which were examined in both of the studies. In the area of *space and shape* (geometric problems), Finnish students' mean score was 539 points in 2003 while the corresponding score three years earlier was 533 points. The increase was small (6 points) but nonetheless bigger than in the 25 OECD countries on average (2 points). Moreover, in 2003 there was even less variation in the Finnish students' performance than in 2000 (the standard deviation was 92 points in 2003 and 97 points in 2000).

In the area of *change and relationships* (algebraic problems), Finnish students' mean score was 543 points in 2003, as compared to the score of 529 points in 2000. The improvement in the performance was 14 points (the average among 26 OECD countries being 11 points) and statistically significant.

In Finland, the clearest improvement was attributable to the high achievers and this meant also a slight increase in the variation of the performance.

Gender gap fairly small in Finnish performance

In PISA 2003, boys outperformed girls in mathematical literacy in all but one OECD country. The gap was 11 points on average. In Finland, however, the gender difference was relatively small – 7 points in favour of boys – but yet statistically significant. This gap was also somewhat bigger than in PISA 2000 (difference then only 1 point).

In Finland, the gender gap was the smallest in the content areas of *space and shape* and *quantity* and widest in *uncertainty* and *change and relationships.* Interestingly enough, in the combined OECD area the gender gap was the greatest just in the domain of *space and shape* (17 points on average) where the Finnish gap was the smallest (2 points).

Summing-up

The findings of PISA 2003 show that Finnish students have managed to achieve both high quality and high equality of mathematical literacy performance. A quarter of students reach excellent performance and a half of students achieve the level of good performance. Moreover, the performance is relatively high in all four content areas. The number of low-achieving students in mathematical literacy is remarkably low by international standards, but on the other hand the percentage of top performers is not as high as it could be. Gender gap in performance is fairly small. Also regional differences as well as those between urban and rural areas are very small. The results confirm that high performance in mathematical literacy can be achieved by taking care of learning across the whole age cohort on an equal basis. The high overall standard allows providing support for the low achievers while also helping the top performers to use their potential to the full.

Reading literacy

As revealed by the mean scores of the PISA 2003 reading literacy assessment, Finland shows the *highest performance* in reading literacy among all OECD countries, even though the difference between the mean score of Finnish and Korean students was not significant (Figure 3). In Finland, also Swedish speaking minority students performed very well. However, the difference between the mean score of the Finnish and Swedish speakers was significant. In Finland, furthermore, high overall reading literacy performance is combined with comparatively *high equity*. This is seen in that in Finland the standard deviation, depicting variation in student performance, is among the smallest in OECD countries.

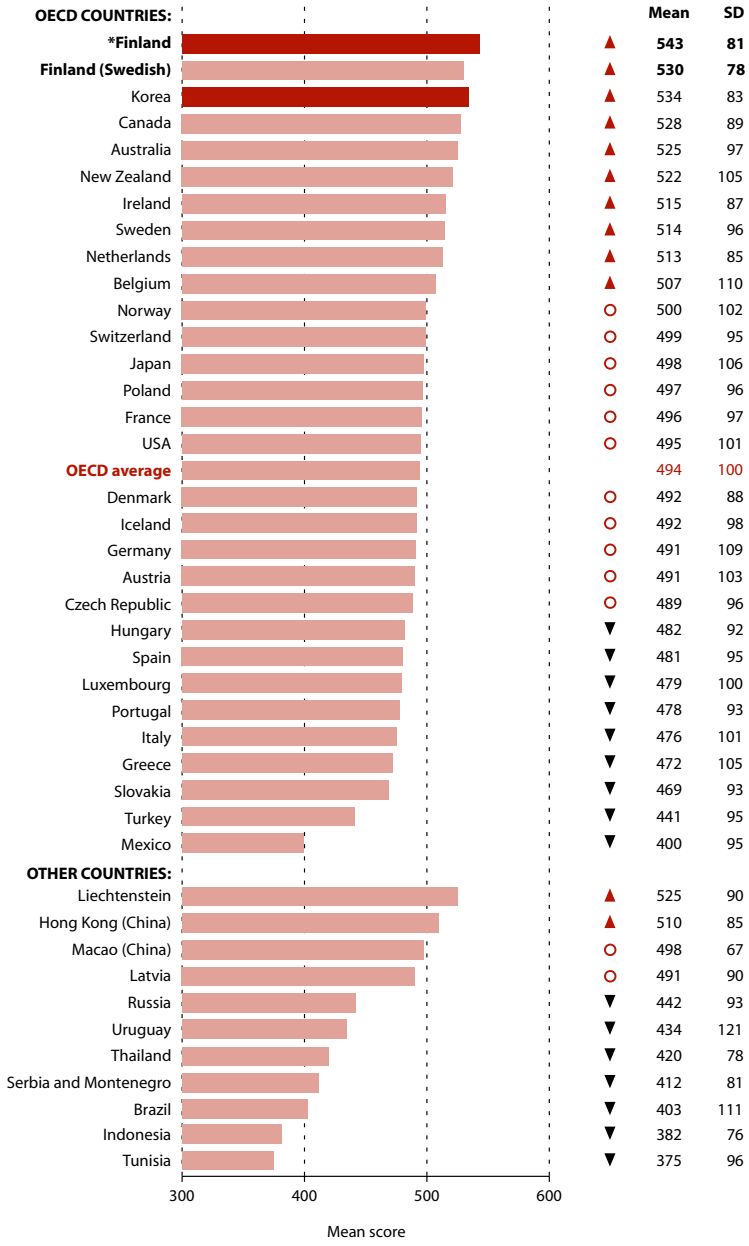
To have a closer look at this variation, students were distributed across five proficiency levels according to their reading literacy scores (Table 1). In the combined OECD area, an average of 8 per cent of students reached the highest reading literacy level, Level 5. In Finland, this level was attained by 15 per cent of students, which was the second highest percentage, together with that of Australia, among all participating countries. The highest percentage of top readers, however, was found in New Zealand (16 per cent).

Proficiency Level 4 was reached by 33 per cent of Finnish students, the OECD average being 21 per cent. This means that altogether 48 per cent of Finnish students ranked among excellent readers (Levels 4 or 5), while the corresponding figure for the OECD was only 29 per cent. Level 3, again,

Table 1 **Percentage of students at different reading literacy levels in Finland and OECD**

Performance level	Finland (%)	OECD (%)
Level 5 (> 625 score points):	15	8
Level 4 (553..625 score points):	33	21
Level 3 (481..552 score points):	32	29
Level 2 (408..480 score points):	15	23
Level 1 (335..407 score points):	5	12
Below Level 1 (< 335 score points):	1	7

Figure 3 **Mean scores for reading literacy**



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was attained by 32 per cent of Finnish students and by an average of 29 per cent of OECD students. In Finland, a total of 80 per cent of students thus reached Levels 5, 4 or 3, the percentage being the highest among OECD countries (the combined OECD area averaging 58 per cent), and seem to have acquired the literacy skills needed to cope with the demands of learning and work posed by today's knowledge societies. High percentages, however, were also achieved in Korea and Canada.

The next proficiency level, Level 2, was achieved by 15 per cent of Finnish students, the corresponding figure for the OECD being 23 per cent. And finally, proficiency at or below Level 1, that is, poor reading skills, was attained by 6 per cent of Finnish students, as compared to the OECD average of 19 per cent. The only country where the proportion of poor performers was as low as it was in Finland was Korea. In the other well-performing countries, the percentage of students at or below Level 1 clearly exceeded that of Finland. By international standards, the number of poor readers in Finland is thus remarkably low; yet, every young person with deficient reading skills risks getting marginalised from further schooling, cultural activities and active citizenship in a society cherishing knowledge, skills and lifelong learning.

Compared to the situation in the PISA 2000, there was no significant change in the Finnish students' mean performance in reading literacy. However, the performance at the top end of the distribution (90^{th} and 95^{th} percentiles) decreased somewhat.

The findings of PISA suggest that as a rule Finland has managed to achieve both high quality and high equity of reading literacy outcomes. In guaranteeing gender equality, however, Finland has been less successful – witness the fact that in PISA 2003 the gender gap in reading literacy was the fourth widest in Finland. Compared to the PISA 2000 assessment and the widest gender gap in reading, the gap has thus narrowed slightly; yet, in relation to other countries, it is still exceptionally wide.

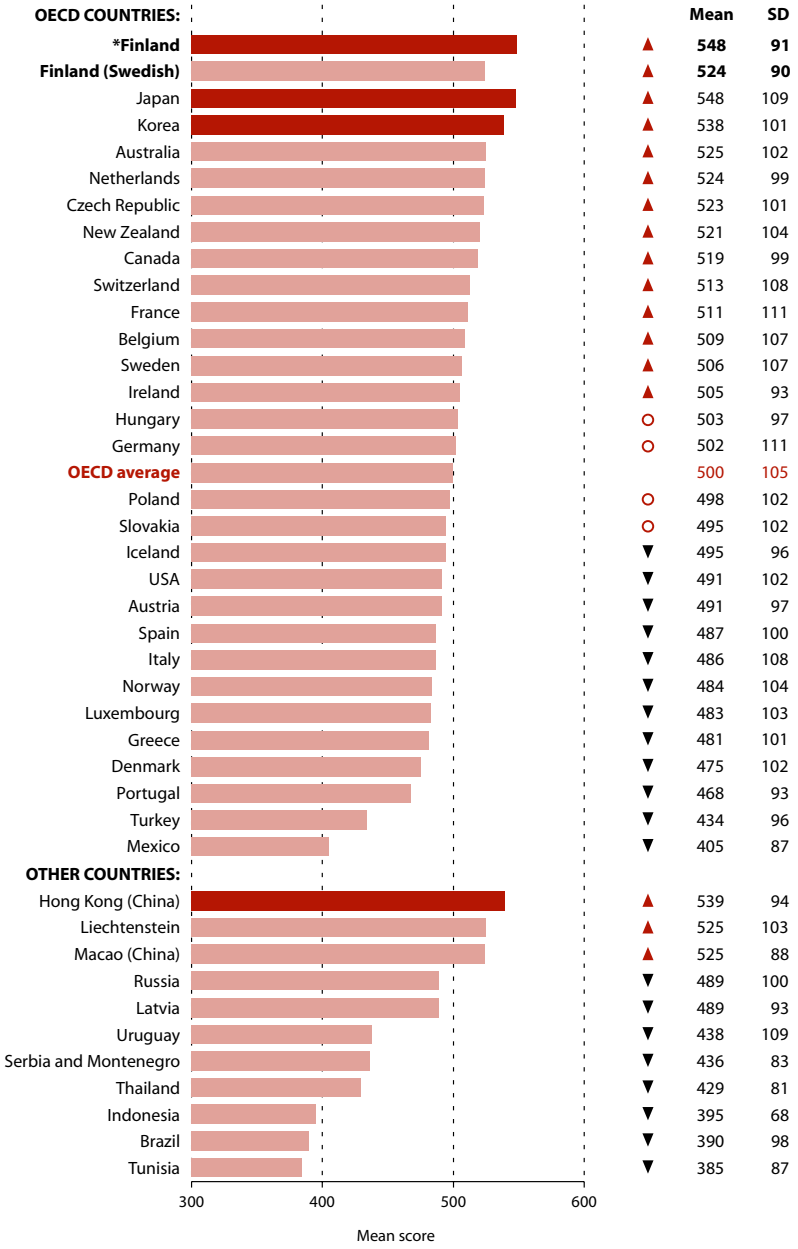
Scientific literacy

The science assessment in PISA 2003 emphasised the application of knowledge focusing on a selection of concepts that are central to science, of enduring relevance, and important to real life. The tasks used in the assessment of scientific literacy emphasised the student's active role in acquiring information. The student had to recognise and tackle scientific questions, select relevant information from competing data and relate this information to knowledge acquired previously. Based on all this information, the student further had to draw valid conclusions and communicate them to others. The tasks were distributed along three science areas. In both *science in earth and the environment* and *science in life and health*, students had to answer 12 items. In *science in technology*, the number of items was 11. The applications covered by the tasks included, among other things, atmospheric change, biodiversity, chemical and physical change, earth and the universe, ecosystems, change of energy, genetic control, geographic change, and human biology. Like in PISA 2000, also in PISA 2003 the scientific literacy was a minor domain and was therefore assessed with relatively small number of items.

As revealed by the mean scores in scientific literacy, Finland's performance in scientific literacy proved to be of high quality (Figure 4), on level with Japan, Korea and partner country Hong Kong. All the other 36 countries showed significantly lower achievement than Finland. Finnish students performed 11 to 13 percentage points above the OECD average in all three science areas.

In Finland, student performance in scientific literacy varied less than in any other high-performing country (standard deviation was 91). In the other high-performing countries, standard deviation was closest in Hong Kong (94). Thus, Finland and Hong Kong seem to be the two countries which have best managed to combine high levels of scientific literacy with low disparities in performance. Moreover, it was the least proficient Finnish students, in international terms the 5th and 10th percentiles of the students,

Figure 4 **Mean scores for scientific literacy**



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who – in relative terms – did extremely well in scientific literacy, and outperformed their counterparts in every other participating country. On the other hand, Finnish top performers scored lower than their Japanese and Korean peers. It seems that Finland is a country where the least proficient students are taken care of exceptionally well.

There are two national languages in Finland, Finnish and Swedish. In PISA 2003 Finnish-speaking students clearly outperformed their Swedish-speaking peers in scientific literacy, with an average difference of 26 points. However, also the Swedish-speaking minority was doing very well, since their results were on a par with those of the Netherlands.

Finland belongs to the group of nine countries where the science achievement was improved from PISA 2000 (mean score 532 points) to PISA 2003 (548). In PISA 2000, there were no significant gender differences observed in scientific literacy in Finland. Girls outperformed boys with only 6 points, which was not a significant difference at the time. Although the gender difference remained in the same 6 points in favour of girls also in the PISA 2003 data, this time the difference proved statistically significant.

Problem solving

Problem solving is a central part of education across the curriculum. The assessment of this domain calls for tasks that are situated in real-life contexts, are not resolvable through the application of routine solutions, and require the student to draw connections between several content areas. In problem-solving items the amount and difficulty of reading required was limited, and no specific scientific knowledge was necessary, although some problems required simple mathematical skills. As the PISA surveys ultimately seek to measure how well 15-year-olds are prepared for life's challenges in general, the problem-solving items are not bound to any specific areas of school knowledge.

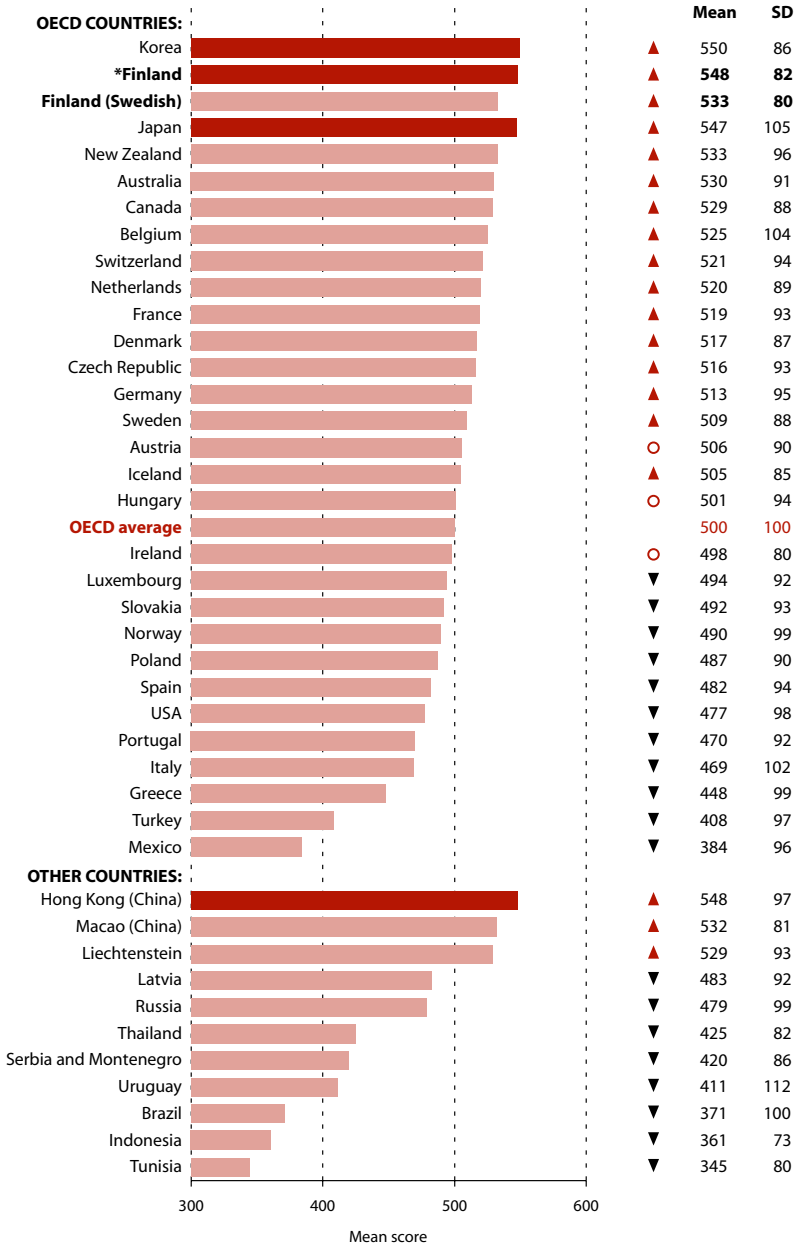
In terms of their mean scores in problem-solving skills, the top group in international comparison consisted of four countries (Figure 5): Finland (548 points), Japan (547), Korea (550) and the partner country Hong Kong-China (548). On the other hand, if strong overall performance combined with low variation is considered, Finland and Korea as well as the partner country Macao-China stood out as top countries. The results of these latter countries show that their good overall performance in country rankings is expressly attributable to the relatively high achievement of their least proficient students. This is the case especially in Finland, where the least proficient students outperform by far their counterparts in other countries, whereas at the high achieving end Finnish students are consistently outperformed by their peers in Belgium, New Zealand, Japan, Korea, and Hong Kong.

In PISA there were three types of problem-solving tasks, which related to decision making, system analysis, and design and troubleshooting. The total number of problem-solving items was 19. In these items students had to show their ability to understand the problem, identify the relevant variables and their interrelationships so as to outline and solve the problem, and finally review and communicate their solution. Finnish students did especially well in decision-making and troubleshooting items, where their percentage of correct answers was about 12–14% higher than the OECD average. Their achievement in system analysis and design tasks was also good, about 7% higher than the OECD average.

Finnish girls were slightly better than boys in problem solving. This difference was only 10 score points, and it was not statistically significant. In practice, this 10 points difference means that the percentage of correct answers was 60 for the girls and 58 for the boys.

In Finland, the Swedish-speaking students achieved significantly lower results in problem solving than their Finnish-speaking peers. The difference was 16 score points.

Figure 5 **Mean scores for problem solving**



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Individual students of participating countries obtained similar results across the three assessment areas, especially in mathematics and problem solving. The correlations between Finnish students' problem-solving scores and scores from the other domains were very high (mathematics 0.98, reading literacy 0.82 and science 0.80) and statistically significant. These results are not surprising, since the key skill needed to solve problems is analytic reasoning, which is also an important requirement for mathematics tasks. Another very likely interpretation is that virtually all PISA items used in different domains represent problem-solving tasks in one way or another.

FACTORS BEHIND THE FINNISH SUCCESS IN PISA

Factors associated with Finland's high mathematical literacy performance

Results from various assessment studies show that many background factors are associated with the variation of students' performance in different content areas. Good performance is usually backed up by a network of dozens of factors, which include students' own interests, attitudes, and learning strategies, learning opportunities offered by home and school, and parents' and schools' expectations. In order to describe the complex relationships between different background factors and mathematical literacy performance in PISA 2003, a multilevel modelling approach was applied. Multilevel models feature two important advantages: they take account of the inherent structure of school data and they treat variables of different levels (student, classroom, school) simultaneously within the same model. Therefore, the multilevel modelling procedure yields more reliable statistical estimates than the use of separate regression analyses.

Altogether 16 factors or indices measured in PISA 2003 were included in the two-level hierarchical linear model (HLM). The factors were chosen to the model in regard of two criteria: first, the factors are strongly connected

with students' mathematical literacy, and secondly, they are supposed to illustrate the great variety of factors that are associated with students' learning outcomes. However, this group of factors is not exhaustive and many other factors could have been included in the modelling.

Table 2 presents the results of the final HLM model for Finland and for the OECD countries on average. Japan could not be included in the OECD model, because they did not have the item related to grade repetition in their student questionnaire. The coefficients presented in the two columns on the right hand side of the table show the associations between the background factors and students' mathematical literacy performance. All factors

Table 2 **The results of the HLM model for Finland and for OECD countries on average in PISA 2003 mathematical literacy**

	Finland	OECD	Finland	OECD
Intercept			546.3	520.4
Student level factor	**Averages (min/max)**			
Gender (1 girl, 2 boy)	1.5	1.5	-11.0	12.3
Grade	8.9 (7/9)	9.6 (7/12)	32.8	26.9
Repeated grade in primary school	1.02 (1/3)	1.08 (1/3)	-40.2	-23.6
Highest occupational level of parents	50.8 (16/90)	48.1 (16/90)	0.6	0.5
Foreign language spoken at home	0.02 (0.1)	0.04 (0.1)	-48.0	-23.3
Size of mathematics class	17.9 (1/35)	24.4 (1/80)	1.6	1.3
Relative time spent on math homework	0.5 (0/1)	0.5 (0/1)	-23.5	-24.7
Student's expected educational level	3.9 (0/5)	3.9 (0/5)	7.3	15.1
Effort invested in the PISA test	7.4 (1/10)	7.6 (1/10)	2.5	2.8
Use of memorisation strategies	-0.2 (-3.5/3.3)	0.1 (-3.5/3.3)	-9.6	-9.0
Self-concept in mathematics	0.0 (-2.1/2.4)	0.1 (-2.1/2.4)	41.7	28.8
Confidence in ICT routine tasks	0.1 (-5,2/0.8)	0.0 (-5,2/0.8)	9.5	8.8
School level				
Teacher support in mathematics lessons	0.1 (-0.8/0.8)	0.1 (-1.9/2.1)	-16.6*	-21.3
Disciplinary climate in math lessons	-0.1 (-1.0/1.0)	0.0 (-1.7/2.4)	10.1*	38.0
Textbook 1 (Finland Swedish)	0.1 (0/1)		-20.6	-
Country level				
Use of memorisation strategies		0.0 (-0.6/0.6)	-	-72.9

* p<0.01, others p<0.001. Reading instruction: Coefficients determine the average change of students' performance scores when the factor value changes with one unit.

in the table were statistically significant predictors of students' performance in Finland.

Table 3 describes the division of the total variance into within-schools and between-schools components and the proportions of variance the model was able to explain both in Finland and in OECD on average. The figures reveal that the overall variation of mathematical literacy performance in Finland derives predominantly (96.6%) from within-schools variance.

In Finland, affective factors related to mathematics were the strongest predictors of performance variation in mathematical literacy. The PISA 2003 student questionnaire explored five different motivational and affective dimensions related to mathematics and, particularly, students' *self-concept in mathematics* was most strongly associated with their mathematical literacy performance in Finland. This was also reflected by the model coefficients (Table 2) because the Finnish coefficient (41.7) was clearly greater than the coefficient in the OECD average model (28.8). Also students' confidence in their abilities to perform routine tasks with computers (e.g. editing, saving and printing files) was quite strongly connected with mathematical literacy performance both in Finland and the OECD countries on average.

Most of the model coefficients in the Finnish and the OECD model seem to be quite close to each other, but one has to bear in mind that the sizes of the coefficients do not tell everything of the models. For example, although the coefficient for *highest occupational level of parents* was a bit higher in

Table 3 **Variance proportions and explained variance in Finland and in OECD countries on average**

	Finland		OECD	
	Proportion of variance (%)	Explained variance (%)	Proportion of variance (%)	Explained variance (%)
Within schools	96.6	49.1	66.9	43.4
Between schools	3.4	51.9	23.4	75.8
Between countries	-	-	9.6	25.4
Total	100.0	49.2	100.0	49.3

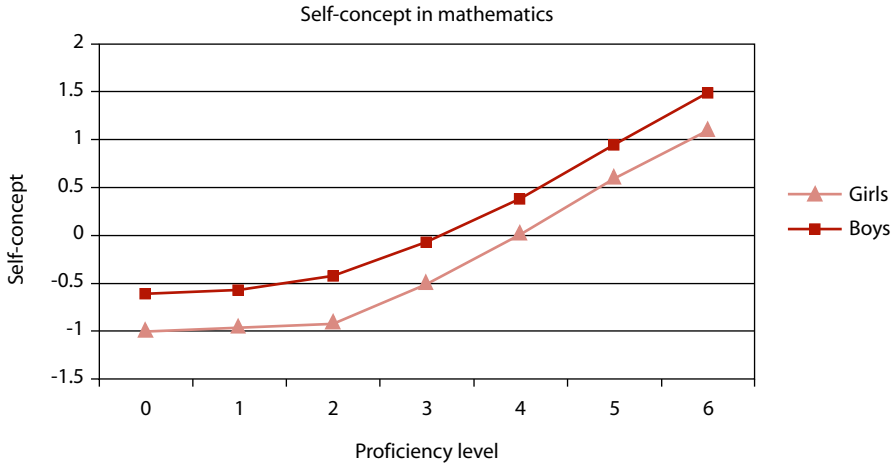
Finland than in the OECD model, the explanatory power of this factor was in fact somewhat higher in the OECD model than in the Finnish one. The coefficients describe the student level connections, but parents' occupational status was quite strongly connected also with performance differences between schools. However, in Finland the between-schools differences were so small (Table 3) that the overall explanatory power of the factor became higher in the OECD average model than in the Finnish model.

The model coefficients show that compared with the OECD average Finland has a very small proportion of students who have a *foreign language as their home language* and Finland also has a very small proportion of students who have *repeated a grade in the primary school*. The situation is worrying, anyhow, because these students reach distinctively lower results than the other students within the system. According to the results, both of these student groups seem to attain over 40 points lower results than the other Finnish students and this is much lower than in the OECD on average (23 points).

Perhaps the greatest difference between the Finnish and the OECD model concerns *gender differences*. Even though the actual performance difference between boys and girls was 7 points in favour of boys in Finland, the model shows a benefit of 11 points in favour of girls. This radical change revealed by the model was mainly caused by the huge gender difference in the self-concept in mathematics (in favour of boys).

Figure 6 shows that boys had much stronger self-concept in mathematics than girls on every level of the PISA 2003 proficiency scale in Finland. Hence, when students' self concept was added into the model, the gender coefficient became negative. This means that if a girl and a boy in Finland have an equally positive self-concept in mathematics, the girl scores on average 11 points higher than the boy in the PISA-type test. Also, in the OECD countries on average boys had higher self-concept than girls in mathematics. The connection of the self-concept was, however, equalised by the fact that girls had higher educational expectations than boys and the educational

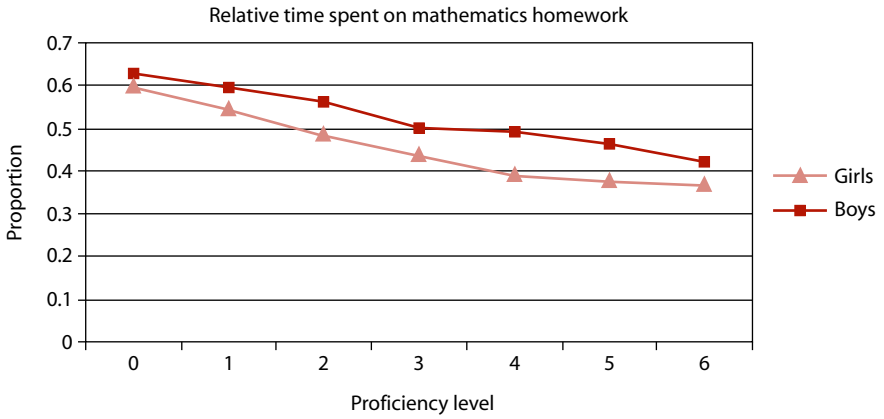
Figure 6 **Finnish students' self-concept in mathematics by gender and proficiency level in PISA 2003 mathematical literacy**



expectations were more strongly associated with performance in the OECD on average than in Finland. In Finland the differences between boys' and girls' educational expectations were so small that they could not equalise the effects of the self-concept differences.

Previous research has shown that actual time spent on mathematics homework is usually negatively connected with performance, indicating that weaker performing students have to spend more time on their mathematics homework than their higher performing peers. Now, the model results (Table 2) show that the same negative tendency holds true also for the *relative time spent on mathematics homework* both in Finland and OECD countries on average. A more detailed picture of this relationship in Finland (Figure 7) shows that the highest scoring students used about 40% of their homework time on mathematics while the proportion was about 60% for the lowest scoring students. Additionally, boys used a higher proportion of their homework time on mathematics than girls, even though girls actually used almost a half an hour more time to their weekly mathematics homework than boys.

Figure 7 **Finnish students' relative time spent on mathematics homework**



Furthermore, the figures in Table 2 show that in addition to the student level factors, several school level factors and even country level factors are associated with student performance. For example, *teacher support in the mathematics lessons* was negatively associated with students' performance both in Finland and in the OECD countries on average. However, this relation must not be seen as causal. Instead, it can be seen as expectable piece of result since students at lower performing schools are actually reporting more teacher support than students who attend higher performing schools. Closely related with the previous factor, *disciplinary climate in mathematics lessons* was very positively associated with students' performance and especially in the OECD model.

The models for Finland and for the OECD countries, as well, suggest that weaker performing students in particular resort to *memorisation strategies* in studying mathematics. The use of memorisation strategies seems to vary also between different educational systems, as this was one of the factors that were found to be significant also on the country level. According to the results, students in weaker performing countries used this strategy more often than the students in higher performing countries.

The countries participating in PISA 2003 had a chance to include additional national items in the questionnaires of the study. Finland made use

of this possibility and asked, for instance, about the textbooks used in the schools. According to the results, *textbooks used* in the Swedish-speaking regions of Finland can be associated with the performance difference of the two national language groups. Only one textbook factor was added in this model and in the case of this Swedish book the students performed on average 20 points lower than their peers using different textbooks.

The models for Finland and for the OECD countries both accounted for about 49 per cent of the total variation of students' mathematical literacy performance (Table 3). More importantly, the model descriptions presented imply that the same factors that are important in Finland seem to differentiate between schools and also between students to a very high degree within other OECD countries as well. However, the OECD model could explain only about 25 per cent out of between-countries variance, which seems to indicate that PISA questionnaires fail in identifying factors that differentiate between countries in terms of their approaches to mathematical literacy. Still, country level variation in mathematical literacy performance accounted only for 10 per cent of the total variance. It seems therefore reasonable to search for the student and school level factors that contribute to students' mathematical literacy within the PISA countries instead of searching for factors that separate the countries.

Reading for pleasure – self-generated learning opportunities

Based on regression analyses of both the PISA 2000 and 2003 data, the single key factors that proved the strongest determinants of reading literacy performance in Finland were students' own interests, attitudes and activities outside school. Finnish students' interest and engagement in reading, which were assessed in PISA 2003 only as a national option, had the strongest explanatory power in reading performance, even stronger than parents' socio-economic or cultural status. This was the case in both language groups, the Finnish and Swedish speakers (Linnakylä, Malin & Taube, 2006). It is

obvious that, as students become more involved in reading in their free time, they equip themselves with self-generated learning opportunities (Guthrie & Wigfield, 2000). In this way, engagement in reading can even compensate for a low socio-economic and cultural background of students' home.

What are Finnish students then reading for pleasure? Newspaper was the most popular reading material outside school (Figure 8). Even 59 per cent of 15-year-olds read a newspaper several times a week and additionally 26 per cent several times a month. The frequency to which young people used e-mail and online publications, however, came close to the popularity of newspapers. In fact, the greatest increase between 2000 and 2003 has been in the extent to which e-mail and Internet publications are availed of. The use of other media has remained unchanged. Magazines and cartoons were read several times a week by one third, fiction by 14 per cent and non-fiction books only by four per cent of students.

Based on their responses of reading activities, Finnish students were grouped by cluster analysis into five distinct clusters (Figure 9), according to the frequency with which they read diverse printed materials as well as e-mails and web pages (Linnakylä & Malin, 2006).

Figure 8 **Frequency of reading various media texts**

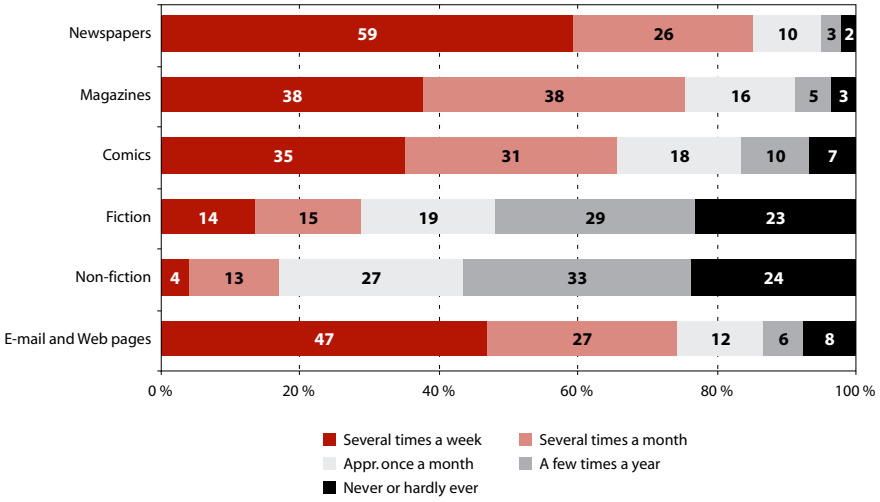
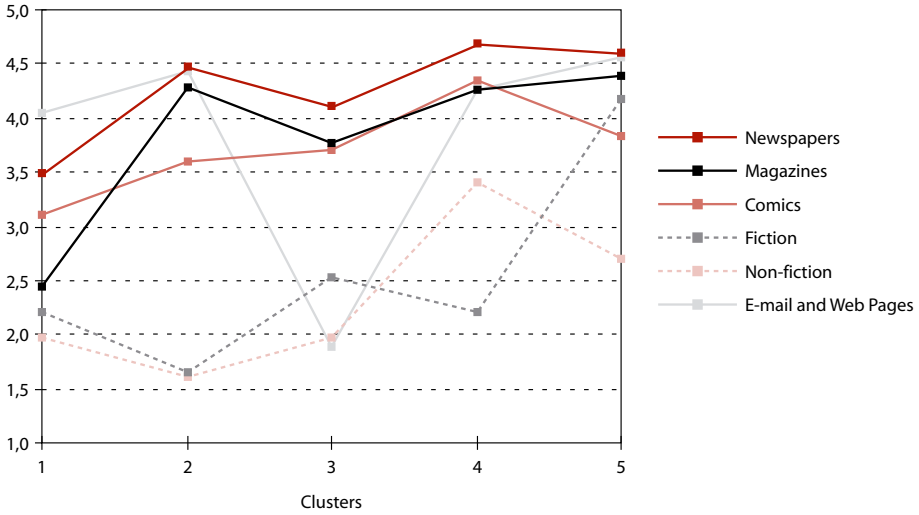


Figure 9 **Reading activity profiles**



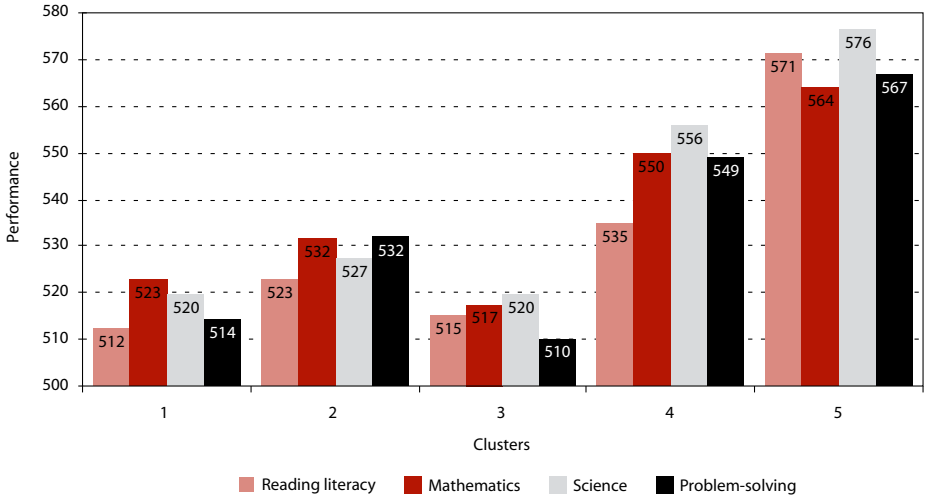
Cluster 1 contains students who use frequently e-mail and web pages but read only seldom fiction or non-fiction books. The cluster contained 15 per cent of Finnish 15-year-old students. Most of them were boys (61 per cent). In Cluster 2, e-mails and web-pages were even more frequently used, but the students in this group also read newspapers and magazines, but not books at all. Some 15 per cent of students fall within this cluster which included relatively even proportions of girls (55%) and boys (45%). In Cluster 3, students were least active Internet users. Instead, they read every now and then newspapers, magazines, comics and sometimes even fiction. This group accounted for 14 per cent of Finnish youngsters and included even proportions of girls and boys. Students in Cluster 4 were the most active readers of newspapers and magazines. These students read quite frequently web pages and non-fiction books as well. The group accounted for 22 per cent of Finnish students and included mostly boys (71%). Cluster 5 contains students who were most active readers of fiction, magazines, Internet and newspapers. Even though they were active readers, they read relatively seldom comics or non fiction books. Fortunately, 28 per cent of Finnish students belong to this cluster. Most of the students in this group, however, were girls (77%).

In summary, Finnish youngsters were divided into sub-groups mainly on the basis of reading fiction and using Internet. Instead, reading newspapers, magazines and comics is so common that students do not divide into distinct groups according to them.

Students' performance across clusters differed prominently and quite similarly in all subject areas assessed in PISA 2003 (Figure 10).

Students in Cluster 5, who were most active readers of fiction, magazines, Internet and newspapers reached the highest performance level in all subject areas but particularly in reading and science. Students in Cluster 4, however, who were the most active readers of newspapers, comics and non-fiction also performed well, particularly in science. Instead, the reading performance was clearly lower which might be associated with the fact that students in this cluster were not active readers of fiction that was a significant part of the reading test. The lowest performance levels were in all subject areas in the Clusters 1 and 3. Students in these clusters were the least active newspaper and magazine readers. Students in Cluster 3 were not active on Internet either which might be fatal for their future, particularly, when connected with low performance levels.

Figure 10 **Students' performance in reading activity clusters**



Furthermore, students in clusters which were most frequent in reading a rich variety of material seemed to adopt the most positive attitudes towards education with respect to both the usefulness of attending school and willingness to continue further studies (Linnakylä & Malin, 2006).

High equality of educational outcomes

Equality in student achievement

Attaining high overall performance while, at the same time, evening out disparities in performance is one of the key aims of national education policy in most OECD countries. In Finland and in the other Nordic countries, this thinking has a long tradition. Providing all students with equal educational opportunities and removing obstacles to learning especially among the least successful students have been leading principles in Finnish education policy since the 20th century. In the light of PISA findings, Finland seems to have managed extraordinarily well in combining these two principles.

The Finnish strategy for building up high quality has been based on the principle of equity and on an effort to minimise low achievement. One of the most interesting findings of PISA, therefore, has to do with the fact that in Finland the gap between high and low performers is relatively narrow. In mathematical literacy in the PISA 2003 data, for example, the standard deviation for student scores proved to be among the smallest and the difference between students with the highest and lowest performance among the least important in the OECD. Indeed, the Finnish performance profile seems to be characterised by the lowest scoring students, in particular, showing a different pattern of performance from that of their fellow students in the other OECD countries (Figure 11). The difference between Finnish top performers and the OECD average, on the other hand, tends to be much less pronounced, albeit clear.

Figure 11 **Means of country percentiles compared to OECD-means (0-level) on the combined mathematical literacy scale**

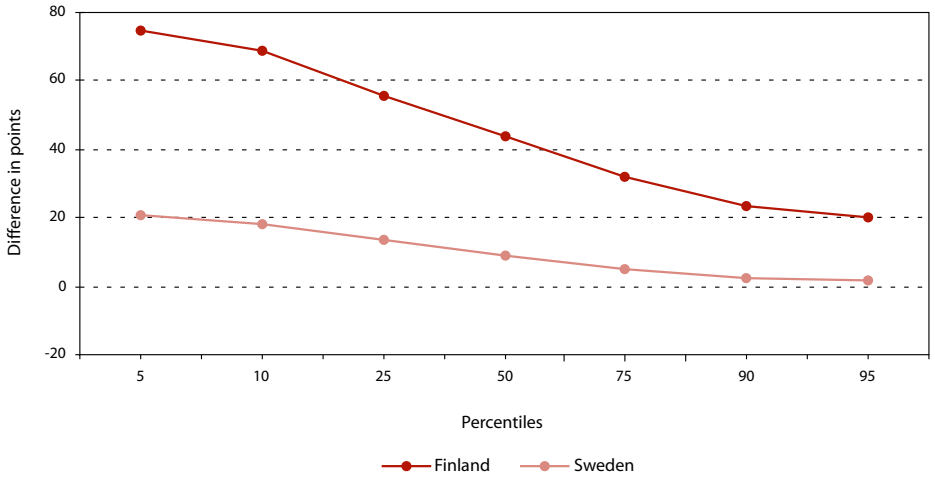


Figure 11 compares the mathematical literacy performance of Finnish students with that of the average in the combined OECD area respectively, the OECD averages set at 0. As shown by the figure, Finnish students did extremely well when compared with their peers in the OECD, the gap being especially marked at the bottom end.

A comparison of, for example, the mathematical proficiency level attained by the weakest 10 per cent (10th percentile) of students reveals that Finnish students outscored their counterparts in the combined OECD area by 69 points. As regards the best students, that is, those scoring above the point reached by 10 per cent (90th percentile) of students, Finnish students outperformed their fellow students in the OECD by 24 points. In comparison with for example Swedish students' performance – another Nordic country – the relatively high level of the weakest performers in Finland is pronounced. Yet, the difference between Finnish and Swedish top performers is also clear.

Figure 11 thus aptly illustrates the realisation of the aim of equality at the Finnish comprehensive school. As shown by the figure, the difference in favour of Finland is the bigger, the lower the performance of students.

Towards the other end of the scale, the difference gets smaller; yet it remains substantial even in the case of top performers. It is noteworthy that this high proficiency of the least successful students is also a major determinant of Finland's high average performance.

The above trends further apply in large measure to reading literacy and scientific literacy, where it was, again, especially the lowest scoring Finnish students that differed from their fellow students in the other OECD countries; moreover, the relative superiority of Finnish girls over Finnish boys was evident especially in reading literacy. In reading literacy, for instance, the difference between the best performing Finnish boys (90th percentile) and their counterparts in the combined OECD area was clear in the PISA 2000 data; in the 90th percentile, as an example, Finnish boys outscored the average of boys in the OCED by 19 points. For girls the corresponding difference was 37 points in favour of Finnish girls.

Equal opportunities to learn

As a token of equal educational opportunities, the differences found between schools in Finland proved among the smallest in the OECD. While these differences accounted, on average, for 34 per cent of the variation in students' mathematical literacy performance in OECD countries in PISA 2003, in Finland only 4 per cent of the variation was between schools. Small between-school variation is a characteristic of all the Nordic countries. This is largely due to the fact that these countries have non-selective education systems where all students are provided with the same kind of comprehensive schooling. In contrast, variation between schools tends to be more pronounced in countries where students are enrolled into different kinds of schools at an early age.

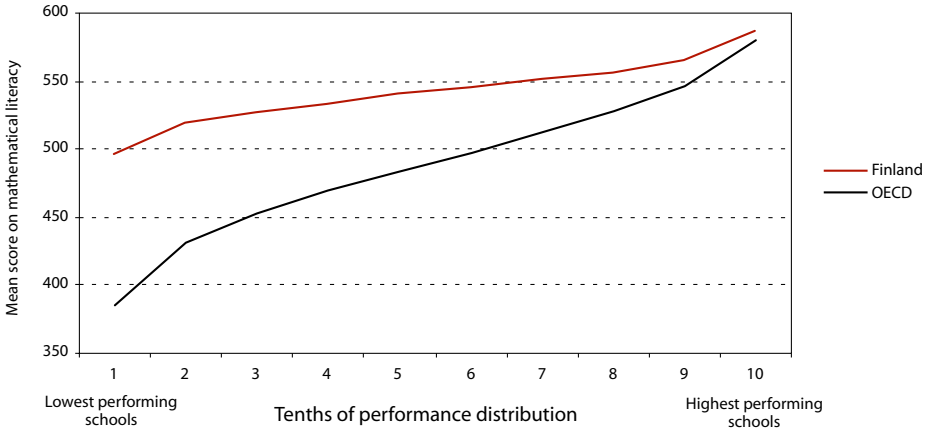
In the light of PISA findings, the Finnish comprehensive school system stands out as exceptional in that in Finland even the least successful schools attain a relatively high level of mathematical literacy when compared with

the other OCED countries (Figure 12). In Finland, the point below which the lowest performing 10 per cent (10th percentile) of schools scored was more than 100 points above the OECD average. The same trend applies to the highest performing schools (90th percentile), even though the difference, in this case, was only 6 points.

From the viewpoint of the goals set for the Finnish comprehensive school, however, the differences found between Finnish schools are not without significance. Even in Finland, the best 10 per cent of schools scored, on average, 91 points higher in mathematical literacy than the poorest 10 per cent of schools. On the PISA scale of mathematical literacy, consisting of six proficiency levels, this represents a difference of one and a half proficiency levels. This poses a true challenge to the development of the Finnish comprehensive school. The challenge is made no less important by the fact that in OECD countries the difference between the two extreme groups was 194 points.

Finland has sought to provide all students irrespective of their place of residence with equal opportunities for high quality education. An extensive network of schools and the recruitment of highly qualified teachers in all schools have been important means in ensuring high educational quality

Figure 12 **Performance of schools on the combined mathematical literacy scale**



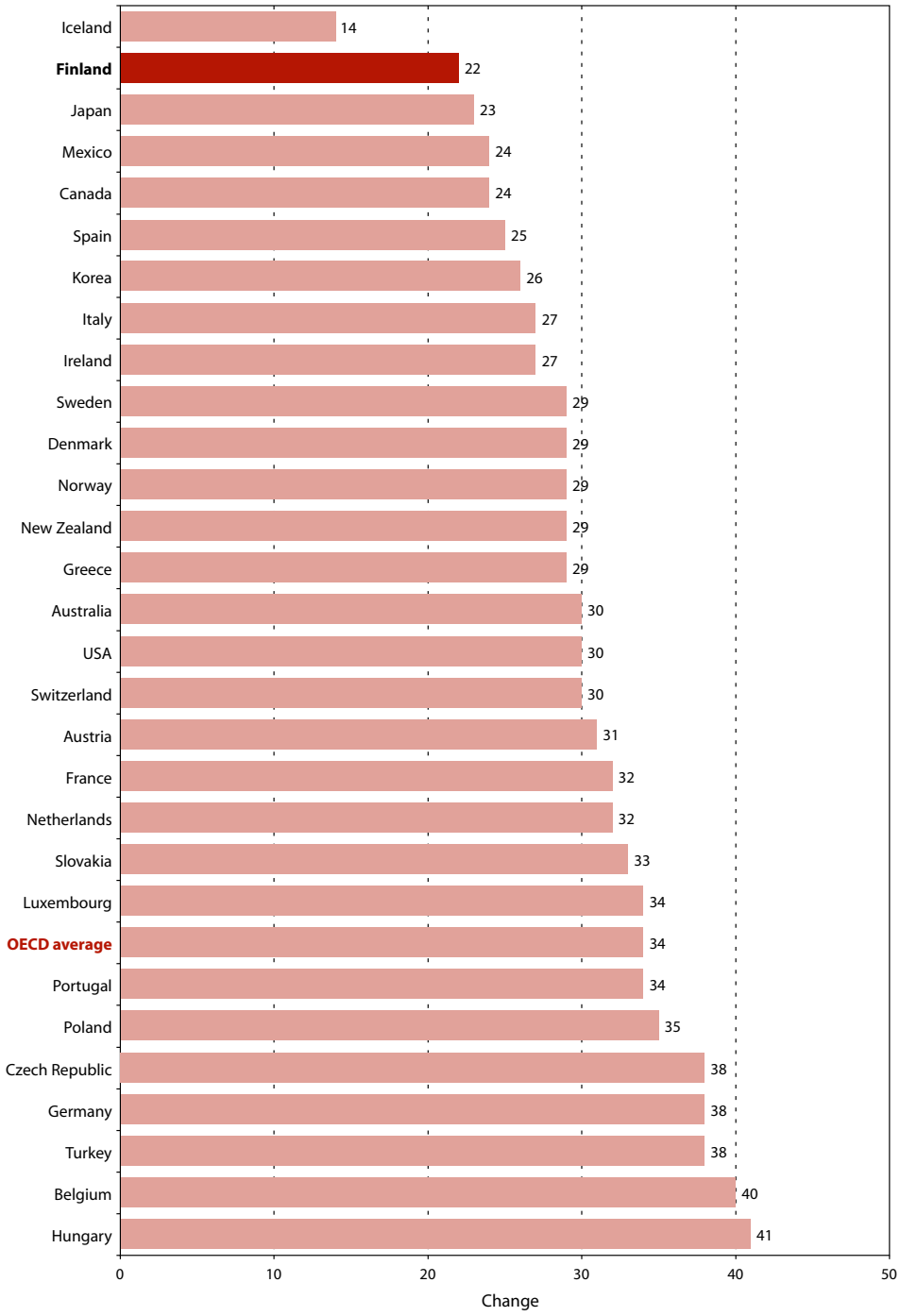
and equality in all Finland. The results are most encouraging, which can be seen in that in PISA the differences found among schools between the different regions as well as the urban and rural areas of Finland proved relatively unimportant. In Finland it is thus of little consequence where students live and which school they go to. The opportunities to learn are virtually the same all over the country.

Equality related to family background

Students come to school from widely differing family backgrounds both in Finland and in the other PISA countries. Family background, as shown by the results of PISA, still has an impact on student performance. In Finland, however, this influence is less marked than on average across OECD countries. Of the factors related to family background, *the socio-economic background of students,* measured as parental occupational status, was the one most strongly associated with mathematical literacy performance in all participating countries. Students whose parents had the highest status jobs significantly outperformed those with lower socio-economic backgrounds. This was especially the case in, for instance, Hungary, Belgium, Turkey and Germany. The difference was considerable in Finland as well, yet remained clearly below the OECD average (Figure 13). In Finland, even students whose parents belonged to the lowest socio-economic quarter performed above the OECD average. These results were quite similar with those of the reading literacy assessment in PISA 2000.

In the participating countries, the impact of *parental education* and *family wealth* on mathematical literacy performance proved less pronounced than that of parental occupational status and varied across the countries. In Finland, these factors had a lesser impact on mathematical literacy than in most of the other countries. The results of the PISA 2000 reading literacy assessment were quite similar in this respect. *The cultural background of the family* also exerts influence on mathematical literacy skills in both Finland and the other PISA countries but not as considerably as in the PISA 2000

Figure 13 **Change in mathematics score in OECD countries while the socioeconomic index increases by one standard deviation**



reading literacy assessment. In Finland according to the PISA 2000 reading literacy data, for instance, cultural communication accounted for as much of student performance as it did on average across OECD countries. Possessions related to classical culture and participation in cultural activities, by contrast, explained reading literacy performance to a lesser extent in Finland as compared to the OECD average.

Challenges to educational equality

The findings of PISA show that some countries have managed to achieve both high average quality and high equality of educational outcomes. This in itself is encouraging in that it implies that inequalities in educational outcomes can be reduced. Finland, for example, has been successful in ensuring small disparities between schools. Parental socio-economic status also has a less significant impact on student performance in Finland than in most of the other PISA countries. On the other hand, Finland has been less successful in ensuring gender equality, particularly as concerns *reading literacy.* As shown by PISA 2000 results, girls outperformed boys in reading literacy in all the participating countries. In Finland, however, the gender gap was widest and proved significant on all three subscales of reading literacy. In 2003 the gender gap in reading literacy has narrowed slightly still being 4th widest in Finland. The gap, nevertheless, is not due to Finnish boys doing poorly but rather to Finnish girls performing exceptionally well. After all, Finnish boys scored better than boys in any other OECD country, except for the Korean boys, and even better than girls in many of the participating countries. The gender differences notwithstanding, the Finnish PISA team is confident that the gap can be reduced without lowering the average level of performance, especially by fostering boys' interest and engagement in reading both at and outside school.

In *mathematical literacy,* on average across countries, gender differences were considerably smaller than in reading literacy. In Finland, practically no differences were found between boys and girls in this domain in 2000

data (the difference in mean performance being 1 point in favour of boys). In 2003 data, the gender difference was slightly wider (7 points in favour of boys) and statistically significant. Still the difference was smaller in Finland than in OECD countries on average. In *scientific literacy,* Finland displayed statistically significant gender difference of 6 points in favour of girls.

Educational environment

Judging from the PISA data, Finnish students seem to show a great number of special characteristics related to attitudes, values and out-of-school activities that support high quality learning. The above, however, constitute only one, albeit important, part of the network of factors that help to explain Finland's high performance in PISA.

A philosophy that works

The Finnish comprehensive school is not only a system (see Appendix 1). It is also a matter of pedagogical philosophy and practice. An intrinsic part of this philosophy is the principle of equity, on which Finnish education policy has been largely premised. Efforts have accordingly been made to provide all population groups and regions of the country with equal educational opportunities.

At the system level, this philosophy is reflected in the extensive network of educational institutions covering the entire country. There are, in fact, over 3,200 comprehensive schools, some 750 upper secondary schools (academic and vocational), 20 universities and a great number of other educational institutions in Finland – and only slightly over 5 million inhabitants.

Education has also been an integral part of Finnish national programmes aiming at cultural development. In a small and remote country with a strange language, the provision of education for all has been conceived as a

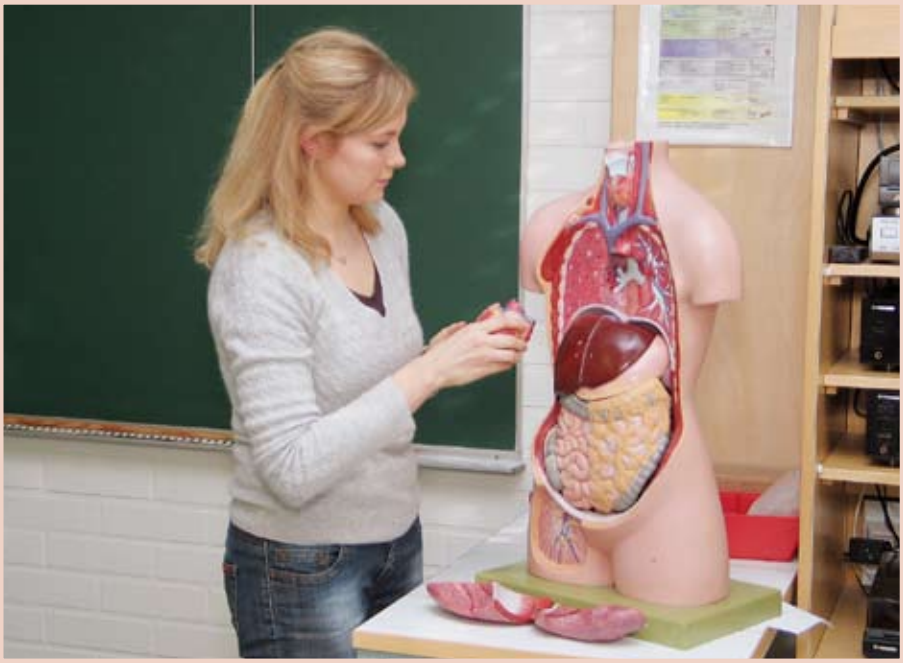
”School is fun!”

”We like working together in projects.”

"The teachers is there to help and guide us in our studies."

”Working in pairs is efficient in mathematics classes.”

"In mathematics students often work individually with assistance from the teacher."



”Materials in biology class illustrate the content of the lesson.”

”In mother tongue class we use a variety of reading materials.”

"The lunch hour is the highlight of the school day."

necessary means for keeping the nation's culture dynamic. A small country, it has been thought, cannot afford to leave any one outside high quality education. This became especially evident during the recession years of the 1990s, which greatly strengthened faith in the significance of education, not least as concerns employment opportunities and economic success.

The Finnish comprehensive school is for each child and, hence, has to adjust to the needs of each child. Instruction and pedagogy at Finnish schools have accordingly been structured so as to fit heterogeneous student groups; Finnish teachers know, for example, that no student can be excluded and sent to another school. In line with this principle, students' own interests and choices are likewise taken into account at schools when planning the curriculum and selecting contents, textbooks, learning strategies, methods and assessment devices. All this calls for a flexible, school-based and teacher-planned curriculum along with student-centred instruction, counselling, and remedial teaching.

Supporting individual students

How is it possible to teach entire age cohorts in heterogeneous groups? An important part of the explanation lies in the fact that comprehensive school pedagogy differs considerably from the pedagogy applied in parallel systems, characterised by explicit tracking and streaming. Heterogeneous groups, for instance, necessitate highly educated teachers, genuine experts in pedagogy. This is largely because in comprehensive systems, the task of the teacher consists in taking care of every single student and allowing, in everyday school work, for a diverse student body. Heterogeneous grouping, as shown by studies conducted in the 1970s and 1980s, when the Finnish comprehensive school was still under construction, and confirmed by the PISA data, appears to be of the greatest benefit to the weakest students; the performance of the best students, in contrast, seems to remain virtually the same irrespective of how the groups are formed.

Special education has likewise played an important role in Finnish schools in catering for students who have problems following regular teaching. Special education is usually closely integrated into normal teaching and is highly inclusive by nature. Indeed, only about two per cent of students attend separate special education institutions. In practice, a student with problems in a certain subject or subjects typically has the opportunity of studying once or twice a week in a small group of 2–5 students or even individually with a special teacher. The special teacher may, alternatively, also attend regular classes. On the primary level (grades 1 to 6), where class teachers have the main responsibility for instruction, special education mostly centres on reading and writing skills along with mathematics skills. On the lower secondary level, foreign languages likewise cause difficulties to a number of students. A student's right to special education is stipulated in the Finnish school laws.

Every student also has a right to student counselling. Schools are to provide students with guidance in study skills, choice of options (e.g. elective courses) and planning of post-compulsory studies. At grade levels 7 to 9, every school has a student counsellor, who provides individual guidance to those in need or desirous of it.

Teaching a heterogeneous student body further presupposes efficient small teaching groups and readiness on the part of the school to reorganise groups if necessary. The results of PISA show that in Finland the average number of students in study groups is among the smallest in the OECD. Nonetheless, Finnish teachers are constantly worried about what they consider too large group sizes, finding it demanding to look after the individual needs of different students.

Highly qualified teachers are a necessity

In Finnish culture, the profession of teacher has been seen as one of the most important professions of society, and a lot of resources have consequently

been invested in teacher education. Teachers have also been trusted to do their best as true professionals of education. From this it has followed that Finnish teachers have been entrusted with considerable pedagogical independency in the classroom and that schools have likewise enjoyed substantial autonomy in organising their work within the limits of the national core curriculum.

In order to cope with a heterogeneous group, a teacher has to be highly educated, a pedagogical expert (see Appendix 2). This is what Finnish teachers are. All Finnish teachers, to start with, have to complete a master's degree either in education or in one or two teaching subjects. Additionally, the teacher's profession, especially that of the class teacher, is greatly valued and popular among Finnish post-secondary students. This can be seen from, for example, the popularity of the class teacher's programme provided at universities. Of all the applicants for this programme, only 10 per cent are admitted, which implies that those accepted are highly motivated and multi-talented students with excellent academic skills. Educating class teachers at universities and the scope and depth of their study programme seem to be the factors that make Finnish teacher education stand out as special, when compared to other countries. These factors further mean that young Finnish teachers, in particular, are well acquainted not only with various teaching methods but also with educational research; many of them, moreover, appear to be well prepared and motivated to develop their professional skills through further education and training.

As revealed by certain comparative studies, Finnish teachers also appear to set high standards for students' literacy skills and interests. Even on the primary level, teachers stress the importance of demanding cognitive aims.

Regarded as educational experts, Finnish teachers are, finally, relied on when it comes to student assessment, which usually draws on students' class work, projects, teacher-made exams and portfolios. In Finland, the role of teacher-based assessment is all the more important because at Finnish comprehensive schools students are not assessed by any national tests or examinations upon completing school or during the school years.

Curricular flexibility and pedagogical freedom

Until the 1990s, the Finnish national core curriculum used to be strict and detailed – the structure, organisation, content, resources and methods of the comprehensive school all established in the curriculum – and textbooks meticulously controlled, the goal being high educational consistency across schools and classrooms. A profound change in curricular philosophy and practice, however, took place in the early 1990s. The national curriculum underwent reorganisation, whereby it became more flexible, decentralised and less detailed. At the same time, questions about the accountability of schools as well as the need for national testing programmes and national grading guidelines gained momentum also in Finland. Today, Finland has national grading guidelines for performance regarded as good (8 on a numerical scale ranging from 4 to 10). These guidelines, however, are far from strict, allowing students' effort and activity to be taken into consideration.

The outcomes of the whole Finnish nine-year comprehensive school are followed by sample-based surveys. Yet, these too are only published on the system level, while the results of individual schools are, in like manner, delivered exclusively to the schools concerned. Finnish schools indeed still have a high degree of autonomy in pedagogical and curricular practices.

This is further confirmed by the findings of PISA, which reveal that Finnish teachers are vested with a considerable degree of decision-making authority as concerns school policy and management. Finnish teachers, as an example, have almost exclusive responsibility for the choice of textbooks. They also have more say than their colleagues in the OCED in determining course content, establishing student assessment policies, deciding which courses the school should offer and allocating budgets within the school. Governing bodies of schools and local educational authorities, by contrast, have less decision-making power in Finland than in the other OECD countries. As a rule, in PISA, countries with greater degrees of school autonomy, including Finland, attained higher average levels of student performance than those with lower levels of school autonomy. A high degree of school and teacher

autonomy in decision-making may thus be assumed to have been one decisive factor contributing to Finland's high performance in PISA.

Paradoxically, shortly after the international publication of the first PISA results, the Finnish government made a decision to harmonise the education system by adding to the share of compulsory studies at comprehensive schools and by giving more weight to core subjects. The potential threat of growing differences between schools and the increasing number of Finnish students falling short in reading literacy and mathematics were the main arguments for the decision. Assessment results and political decision-making on education do not always go hand in hand.

Cultural homogeneity

In the long term, the development of the Finnish comprehensive school has been underpinned by an exceptionally broad cultural and political consensus about the main lines of national education policy. In Finnish culture, grave political conflicts and sudden changes in educational thinking have been relatively rare. Throughout the 20th century, for instance, educational services were developed evenly and in agreement with the needs of different population groups and regions. Today – largely thanks to the high quality of Finnish teacher training – high-grade education is provided at every school. This, again, is reflected in Finland's below average variation in educational outcomes at both the individual and system level.

Owing to cultural homogeneity, it has been comparatively easy in Finland to reach mutual understanding on national education policy and the means for developing the education system. Even the comprehensive school reform of the 1970s was introduced without huge political contradictions. There was, in fact, a broad national consensus in the 1960s and 1970s that the parallel system should be replaced by a more equal comprehensive school system. To date, education has thus seldom been a subject of major political or social controversies in Finland. Suspicions have, admittedly, been

voiced that comprehensive school education evens out and, hence, lowers the level of performance, especially as far as the gifted are concerned. A few years ago, it was further suggested that university-level teacher education be abandoned and resubstituted by college-level teacher training. These discussions, however, never gained wide currency. Today, the situation appears to be changing. This is evident from the lively debate sparked off by the results of PISA in Finland, particularly when compared to results of some national assessments, displaying various defects in the knowledge and skills of Finnish students as well as growing differences between schools. All this seems to imply that in the years to come, finding common values and a political consensus about central educational issues may be getting more difficult also in Finland.

As a culturally homogeneous country, Finland has further been exemplary in taking care of its minorities. In Finland there are two official languages, Finnish (94 per cent of the inhabitants) and Swedish (6 per cent). Both of these language groups are equally entitled to and have equal resources for education in their own language from the pre-primary level up to the university level. Other minorities in Finland, however, are relatively small. In the PISA data, for example, non-native students accounted for a mere 1.8 per cent (the OECD average being 4.6 per cent) and those not speaking the language of assessment for 1.8 per cent of all Finnish students (compared to the OECD average of 4.5 per cent). With the prospective increase in the number of these students, Finland too may be expected to be faced with entirely new educational challenges.

* * *

All in all, the results of PISA suggest that there is no single key factor behind Finland's successful performance in PISA. Rather, Finland's high achievement seems to be attributable to a whole network of interrelated factors, in which students' own areas of interest and leisure activities, the learning opportunities provided by schools, parental support and involvement as well as the social and cultural context of learning and of the entire educa-

tion system combine with each other. The above factors aside, mention should also be made of certain basic services that are well tended by the Finnish comprehensive school, such as offering free warm meals and school health services to all students and providing social, psychological and pedagogical support to students with special needs. All these factors help to even out variation in learning outcomes among students with divergent family backgrounds and individual skills.

CHALLENGES TO THE FINNISH COMPREHENSIVE SCHOOL

The Finnish comprehensive school seems to be successful in providing the majority of its students with a solid foundation for further schooling, for transition to working life and for full participation in modern society. The results also predict an auspicious future for the whole nation, whose cultural originality, economic success and social equity are all premised on the performance and thirst for learning of every citizen.

Taken together, the Finnish PISA findings further show that an education system can succeed in combining high quality performance with high equality. The pursuit of equality, however, will also have to be a leading principle in the future development of the Finnish comprehensive school. The depth of the Finnish tradition of equality, in fact, will shortly be put to a severe test owing to the increasing numbers of immigrant students and growing cultural heterogeneity. To tackle this problem of equality, Finland will understandably have a lot to learn from countries which, unlike Finland, have had ample experience in immigration both in the past and in the present.

Even though the performance of Finnish students, in the light of PISA, proved excellent, there is still room for improvement. Yet, these improvements presuppose increasingly allowing for the individual needs of students. In PISA, for example, 15 per cent of Finnish students were found to have some and a further 6 per cent severe difficulties in coping with the literacy demands of today's knowledge society. By international standards, the proportion is small, yet from the Finnish point of view, it is far too high. The Finnish comprehensive school will therefore have to continue struggling to decrease, or preferably to dispose of altogether, the proportion of these students at risk.

Gifted education pedagogy has traditionally got meagre attention in Finland and has often been mistaken for an alternative to the concern shown for the least successful students. Yet, it seems that even the development of students with widely differing knowledge and skills can be appropriately strengthened in heterogeneous groups as long as the teacher is capable enough and has sufficient resources for within-group differentiation. This, however, appears to be jeopardised in today's Finland by the increase in the average teaching group size, brought about by economic retrenchment. Moreover, as another step towards developing the education of the gifted, national education policy should advance a pedagogy that pays greater attention to individuality, self-esteem and self-regulation instead of exclusively emphasising the importance of common core skills. This, again, might further strengthen students' ability to reflect on and critically evaluate the information they receive.

In PISA, Finnish students' and especially principals' perceptions of school climate proved, on average, much more negative than those of their fellows in the OECD. This is significant in that school climate and satisfaction are known to influence students' motivation for and attitude to learning and, in turn, the development of knowledge and skills essential in post-compulsory studies and lifelong learning. School principals, in particular, would therefore be expected to be more confident of their possibilities of stimulating in teachers and students alike a desire to improve the well-being of their own schools and to work for a peaceful and innovative learning environment. True, the Finnish comprehensive school does face a host of problems caused

not only by social development but also by a change in students' values and behaviour patterns. These, however, remain within reasonable limits and should not mask the fact that, on the whole, the Finnish comprehensive school rests on a solid basis and exhibits high quality performance.

On the domain of mathematical literacy, special concern seems to be students' attitudes towards mathematics, particularly in the case of girls. Finnish students showed surprisingly low interest in mathematics in international comparison. Especially girls' interest in mathematics, girls' confidence in their possibilities of learning mathematics and enjoyment in learning mathematics were inconsistent with their high performance on the mathematical literacy scale. The high prevalence of negative attitudes is worrying because interest in and confidence with mathematics seems to have a strong steering influence when young people select their further studies. Increasing students' confidence and enjoyment in the area of mathematical literacy is thus a major pedagogical concern that requires a critical evaluation of the methods of learning and materials used in mathematics instruction. In part this is, however, a larger cultural concern as there seems to be a strong tradition of labeling mathematics as a male domain in Finland.

Furthermore, the results in mathematical literacy in PISA 2003 pose a challenge to the Swedish-speaking schools in Finland as the proportion of top performers in these schools was clearly lower than in Finnish-speaking schools. In part this may be due to the inconsistency between home language and the language of education. Nevertheless, more research is required in order to find pedagogical solutions for increasing the performance level in mathematical literacy in Swedish-speaking schools.

On the domain of reading literacy, Finland's greatest challenge appears to be concerned with the wide performance gap between boys and girls, brought about, among other things, by gender differences in values, goals and out-of-school activities. To reduce the gender gap, innovations that seek to stimulate interest and engagement among boys in literary culture and that help them to find enjoyment in reading are thus badly needed. To this end,

information networks, as an example, which largely rest on the ability to read, might be taken fuller advantage of. Apart form the above, gender differences in performance further relate to differences in psychological and socio-cultural constructs, which can be seen, among other things, from the wide variation found between Finnish girls and boys in self-confidence as concerns both mathematics and reading. Of these two domains, mathematical literacy is still felt to be a definitely male domain, while reading literacy is thought of as a female one. An intriguing question calling for further exploration, then, is why this difference is no more reflected in mathematics performance, whereas in reading literacy it has led to an ever widening gender gap in performance.

Another pedagogically interesting finding relates to the Finnish tendency of using school homework as a tool for controlling student involvement, whereas in numerous other countries homework mainly aims at actively supporting class interaction. This difference is primarily seen in that in Finland, students' homework is assessed, is given feedback on and impinges on marks much less frequently than on average across OECD countries. Homework thus appears to be one area where Finnish pedagogy would greatly benefit from the experience of other countries. This is especially true in the case of high performers, who spend little time on homework and who would therefore be expected to find more challenging tasks, research projects as well as reflective and argumentative writing profitable.

In Finland, students' learning strategies showed a fair relationship with performance. High performance was accordingly associated with students' above average awareness of their own learning strategies and their ability to control the learning process. In today's world leaning on dynamic and networked knowledge, this ability is gaining ever greater momentum. Learning strategies also constitute an integral part of lifelong learning skills. Understandably then, the development of effective learning strategies – identifying, consciously developing and monitoring the efficiency of these strategies in the various content areas of the school – will continue to be one of the major pedagogical challenges and goals of the Finnish comprehensive school.

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APPENDIX 1

THE FINNISH EDUCATION SYSTEM*

The Finnish education system consists of comprehensive school education (the primary and lower secondary level), post-comprehensive general and vocational education (the upper secondary level), and finally, higher and adult education (the tertiary level). For all these levels, and moreover, for the pre-primary level, Finland has two parallel systems, one for Finnish-speaking (94% of the population) and the other for Swedish-speaking (6%) students, with Swedish-speakers mainly living in coastal areas in the south and west as well as in the self-governing Province of Åland. Both these systems have, on a national level, identical educational goals.

The officially expressed future goal of Finnish education policy is threefold – to streamline the education system, to develop it in line with the principles of equity and lifelong learning, and to make it internationally competitive.

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* Adapted from the Ministry of Education web-site, 2002.

Preschool and basic education

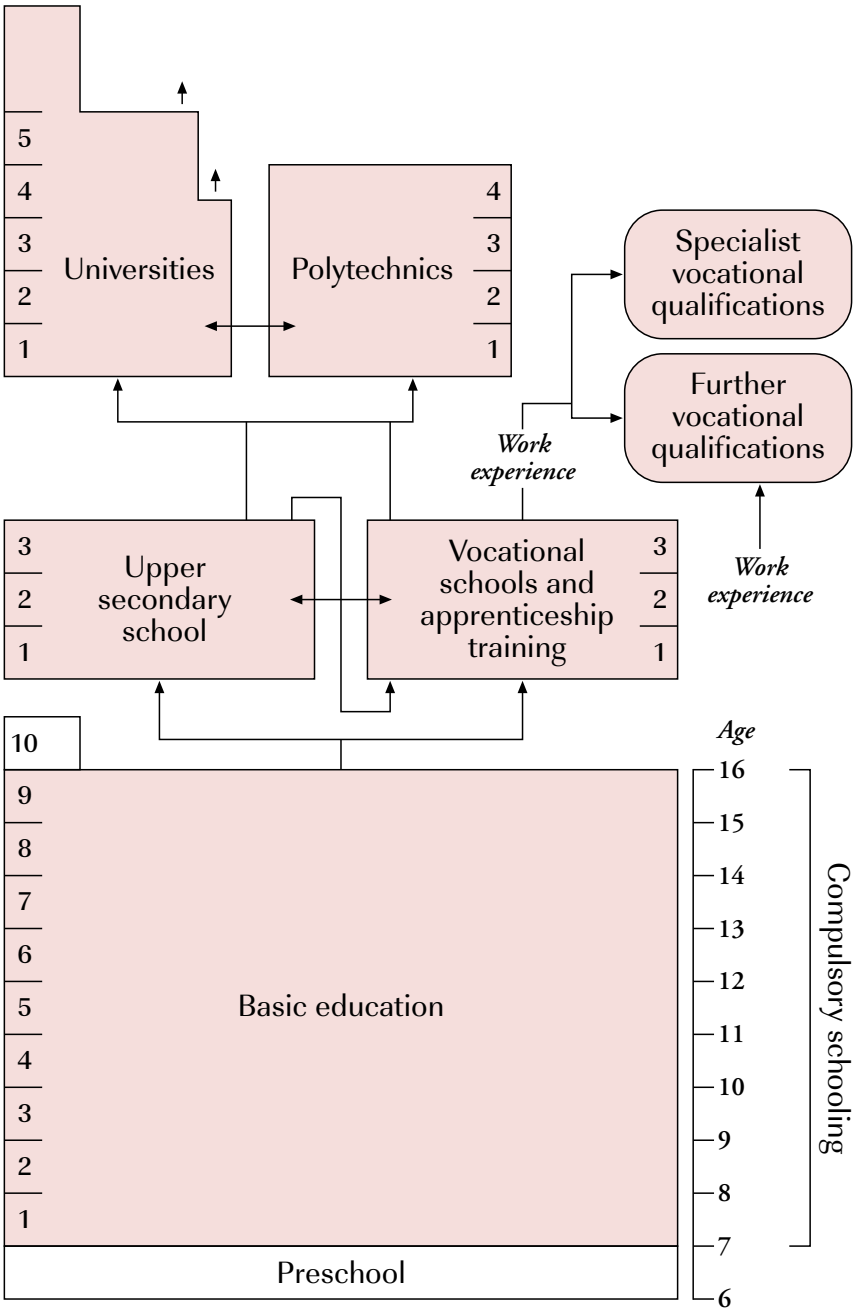
In Finland, children generally start school at the age of seven. Before going to comprehensive school, children may participate in one-year preschool education, mainly provided by social authorities at day-care centres. However, only about 10 per cent of preschool education is arranged by education authorities. Free preschool education is provided for children aged 6 in conjunction with comprehensive schools. Nowadays, about 93 per cent of all 6-year-old children take part in preschool education.

Finland has nine years of compulsory schooling. Usually, for the first six years of comprehensive school, the children are taught by a class teacher, who generally teaches all or at least most subjects. Then, during the last three years, the different subjects are taught by specialised subject teachers. In Finland, 99.7% of the age group complete compulsory schooling.

The school network covers the whole country. Comprehensive schools are primarily run by local authorities, with the exception of a few private schools. The government contributes to the financing of all schools. For children, the teaching and educational equipment are free of charge. In addition, pupils get one free warm meal a day. This tradition of free school meals goes back fifty years. As a rule, transportation is arranged by the education provider for distances of 5 km and over. The smallest schools have fewer than ten pupils, and the largest ones 900. There are some 3,200 comprehensive schools in Finland. The schools can develop individual profiles by focusing on some area, such as languages, mathematics, sciences, sports, music or arts.

Statutes determine the core subjects which all pupils study, and the government determines the national objectives for education and the number of classroom hours allocated to each subject. At comprehensive schools, all pupils thus study the same core subjects with similar instructional contents. Besides this, learning usually takes place in heterogeneous groups. All this means that the core programme is almost identical to all students. Yet, of all

The Finnish education system



classroom hours about 20 per cent are reserved for optional subjects freely chosen by the pupil and his or her parents. Optional studies may include courses in, for instance, foreign languages, sports, art and music, or integrated or in-depth courses or applied studies in the core subjects.

Both comprehensive schools and general upper secondary schools have a broadly based system of counselling that underpins the development of the pupil and provides guidance in studying, career planning and choice of further studies. The purpose of counselling is to ensure that every young person leaving school is aware of what choices of further education are open to him or her and what working in the adult world entails, and that the pupil has a clear plan for his or her own future.

Pupils with learning difficulties are entitled to remedial education. Since 1997, educational authorities have been responsible for the education of all children, including those with profound developmental disabilities. The aim is to integrate special-needs education as far as possible into ordinary schools, but there are those who benefit more from separate special-needs education.

There is no actual graduation certificate or qualification to be gained upon completing comprehensive school, but once one's compulsory education is over, it opens the way to all secondary education options, i.e. different types of vocational training or upper secondary school.

Upper secondary school (academic) and vocational institutes

After comprehensive school, young Finns can choose between general and vocational upper secondary education. Half of them opt for general upper secondary education. Like comprehensive schools, some of the upper secondary schools also specialise in a particular subject; currently there are 50 specialised schools. General upper secondary education comprises a minimum of 75 courses (each comprising 38 class hours), 45–49 of which are

compulsory. The curriculum has been designed to extend over three years, but because there are no specific year classes pupils may graduate in a longer or shorter time than this.

Upper secondary school ends in a national matriculation examination, which comprises tests in the mother tongue (Finnish/Swedish/Sami), the second national language (Finnish/Swedish), the first foreign language, mathematics and general studies. It is possible to take tests in optional languages in addition to the compulsory foreign language. The matriculation certificate provides eligibility for higher education.

In Finland initial vocational education and training is mainly institution-based. Measures are being taken to add to the share of work-based learning in vocational education. Young people increasingly study for qualifications in apprenticeship training. In addition, longer periods of on-the-job learning will be included in institutional training programmes. All secondary level vocational programmes take three years to complete; of this time a minimum of six months is devoted to practical on-the job training.

Administration and resources

Nearly all publicly funded education, from primary to higher, is steered or supervised by the Ministry of Education. The existing private institutions also rely heavily on public funding, and the education they provide is subject to public supervision. The universities are state institutions and funded directly from the state budget; the central and local authorities provide most of the funds for the other educational institutions.

The Ministry of Education is in charge of the administration of education, research, culture, youth issues and sports; its remit includes all universities. In matters related to comprehensive and upper secondary schools, vocational institutions and adult education, the Ministry is assisted by an expert agency, the National Board of Education.

In Finland, public education accounts for 14 per cent of all public expenditure. Some two thirds of this consists of State funding and one third of municipal funding. Trends in education budgets were favourable until the early 1990s. Public expenditure on education accounted for some 6.0 per cent of Finland's gross domestic product in 1990. Following a sharp downturn in GDP, education spending rose to 6.8 per cent in the early 1990s. In 1996 public expenditure on education accounted for 6.4 per cent of Finland's gross domestic product.

APPENDIX 2

TEACHER EDUCATION*

Historically, teacher training in Finland has taken shape gradually and separately for each school type and even for each individual type of teaching assignment. However, the idea about academic training for all teachers, including also primary and even kindergarten teacher training, has a long tradition in Finnish educational discussion.

Prior to the comprehensive school reform of the 1970s, the issue of teacher training was the subject of many major controversies. The issues to be solved included the unification of teacher training and the implementation of the principle of a single degree, the transfer of training from teacher training colleges to institutions of higher education and the harmonisation of theoretical and practical training, on the one hand, and pedagogy and other disciplines, on the other. The Teacher Education Act was ratified in December 1971, and resulted in the final transfer of training for comprehensive and upper secondary school teachers to the university sector. New teacher training objectives were drawn up for comprehensive and upper secondary school teachers, according to which training was divided into class and subject teacher training. This division still applies today.

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* Adapted from the National Board of Education web-site, 2002.

University-level teacher training is currently provided by eleven universities in Finland. The teacher training system is twofold: part of the responsibility for training lies with the faculties of education, while another part is carried out in co-operation with the faculties of different teaching subjects. The faculties of education are responsible for training kindergarten teachers, class teachers, special education teachers and student counsellors, as well as teachers of home economics, technical work and, to some extent, music teachers too. Other subject teachers are trained in co-operation between departments of teacher education and different subject departments.

Class teacher training

Class teacher training leads to the Master's degree in education. The premise of the training is for students to familiarise themselves with holistic human development as well as interaction between the teacher and the learner. The students are further expected to familiarise themselves with scientific theories concerning the educational, learning and development process and their applications to practical educational work so as to be capable of creating their own meaningful working theories.

The training emphasises the theoretical and methodological contents of multidisciplinary educational science and the subjects taught at school and their practical applications. The objective is to link teaching and study to scientific research in order for students to become capable of independently analysing and solving educational problems and of developing their work through research.

The main subject in class teacher training is education. It will provide the theoretical foundation for discharging teaching duties. A further objective of the educational studies is to lead students to scientific thinking and research. The scope of the Master's degree in education is 160 credits, and students with the degree are eligible for postgraduate studies in education. The pedagogical studies of teachers are partially included in the studies in education.

The degree usually consists of the following study modules:

- language and communication studies or equivalent, 12 credits;
- education, 75 credits;
- teachers' pedagogical studies, 35 credits;
- multidisciplinary studies in the subjects and thematic subject modules taught at comprehensive school, 35 credits;
- subsidiary subject studies, 30–35 credits (including either two basic study modules with a scope of 15 credits each or one subject study module with a scope of 35 credits);
- free-choice studies, 3–8 credits.

In recent years, several degree programmes with different emphases have been launched in class teacher training, such as English-language class teacher training, multiform training intended for adult students, a degree programme with emphasis on education in media and communications, and a degree programme focusing on the application of technology.

Subject teacher training

Subject teacher training includes studies in one or two teaching subjects and the teachers' pedagogical studies as part of the Master's degree. A teaching subject means a subject included in the curriculum of basic education, upper secondary school or some other educational institution. Studies in a teaching subject mean studies that promote the command of the subject as required by teaching work. Teaching subject studies consist of advanced studies in one subject, with a minimum scope of 55 credits, and subject studies in a possible second subject, with a minimum scope of 35 credits.

Subject teacher training is provided by universities in accordance with the division of work laid down in decrees governing degrees in different fields. The training is divided into two tracks: the faculties of education are responsible for some training, while another part of the training is carried out in

co-operation between teacher education departments and different subject departments. The faculties of education are responsible for the training of subject teachers in home economics, textile work, technical work and, to some extent, subject teachers in music, as well as special education teachers and student counsellors.

Subject teacher training is regulated by field-specific decrees. Students apply directly to subject teacher training (such as training for subject teachers in mathematics, physics and chemistry or religion). In addition, it is also possible to graduate as a subject teacher by separately finishing the teachers' pedagogical studies upon completion of a university degree.

For the majority of people who complete subject teacher training, the pedagogical studies consist of study contents orientating towards teaching work. The pedagogical studies of teachers provide students with the pedagogical capabilities required for independent performance of teaching duties at comprehensive schools, upper secondary schools and other educational institutions. These studies may provide specific orientation towards teaching duties at comprehensive and upper secondary schools as well as at vocational institutions or in adult education and training.

The basic objectives of the pedagogical studies are to

- develop those extensive learning and competence skills of students which current and future society requires of the teaching profession;
- train experts in the field of education and teaching, who are capable of facing changes in society and in the living environment, because the role of future teachers and educational experts will be to support the skills- and knowledge-related, socio-ethical and psychological growth and development of children, young people and adults.

The training places emphasis on students' own commitment, self-direction, and personal and collaborative learning experiences in their growth towards becoming teachers.

Strong theoretical thinking, reflection on and evaluation of one's own actions and development as well as guidance towards good teaching practices are very important in the studies. The objective is for students to develop into teaching professionals, who will develop their own work and working community.

The scope of the studies is 35 credits (the subject study module in education), and students may include these in their degree as a subsidiary subject. The studies consist of the following themes, for example:

- education, schooling and culture, 9 credits;
- learning environments and interaction, 9 credits;
- research and professional practices in education, 8 credits;
- specialist and advanced studies in professional practices, 9 credits.

The total annual intake to subject teachers' pedagogical studies is about 1,500 students.

Student counsellor training

In the Master's degree, training for student/pupil counsellors includes a main subject in some field of education, the teachers' pedagogical studies either as part of the main subject or as a separately completed study module and studies in student counselling. The scope of student counselling studies is 35 credits, and they provide professional capabilities for student counselling. Studies in student counselling may also be completed separately upon completion of an appropriate degree or training. People may apply for separate studies in student counselling, if they are qualified to teach in basic education, at upper secondary schools or vocational institutions, or if

they have completed some other higher education degree and have worked in teaching and counselling assignments.

Training for special education teachers

Training for special needs teachers and special class teachers leads to the Master's degree in education. This Master's degree includes special pedagogy as the main subject, the teachers' pedagogical studies either as part of the main subject or as a separate study module and studies in special education. The scope of special education studies is 35 or 50 credits, and they provide professional capabilities for special education assignments. The training also includes elective subsidiary subject studies.

In addition, training for special class teachers, similar to ordinary class teachers, includes multidisciplinary studies in the subjects and thematic subject modules taught at comprehensive school with a scope of 35 credits. Special class teachers gain broader teaching qualifications than special needs teachers to teach within both part-time special education and class education.

The studies in special education may also be completed as a separate study module upon completion of an appropriate degree or training. Students admitted to separate studies in special education are either qualified class teachers or have completed some other higher academic (Master's) degree or a higher education degree appropriate in the field of special education for children with intellectual disabilities. Training in pre-primary level special education is open to kindergarten teachers.

Countries participating in PISA

OECD COUNTRIES

- Australia
- Austria
- Belgium
- Canada
- Czech Republik
- Denmark
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- Irland
- Italy
- Japan
- Korea
- Luxembourg
- Mexico
- Netherlands
- New Zealand
- Norway
- Poland
- Portugal
- Slovakia
- Spain
- Sweden
- Switzerland
- Turkey
- United Kingdom
- United States

OTHER COUNTRIES

- Brazil
- Hong Kong (China)
- Indonesia
- Latvia
- Liechtenstein
- Macao (China)
- Russia
- Serbia and Montenegro
- Thailand
- Tunisia
- Uruguay

The success of Finnish students in PISA has been a great joy but at the same time a somewhat puzzling experience to all those responsible for and making decisions about education in Finland. At a single stroke, PISA has transformed our conceptions of the quality of the work done at our comprehensive school and of the foundations it has laid for Finland's future education and development of knowledge.

Thanks to PISA, Finnish schools and school practices have suddenly been brought into the focus of international attention. Why are Finnish students performing so well? What is the secret behind the Finnish success?

In this publication, we as the researchers responsible for the implementation of PISA in Finland, try to open up some perspectives on the possible reasons underlying the high performance of Finnish students in PISA. There is, in fact, no one single explanation for the result. Rather, the successful performance of Finnish students seems to be attributable to a web of interrelated factors having to do with comprehensive pedagogy, students' own interests and leisure activities, the structure of the education system, teacher education, school practices and, in the end, Finnish culture. Perspectives on this web of explanations will be opened up not only by analysing the results of PISA but also by considering some characteristics of the Finnish education system and our cultural heritage which, both at and outside school, can be thought to have contributed to Finland's successful performance.

OECD PISA

INSTITUTE FOR EDUCATIONAL RESEARCH
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