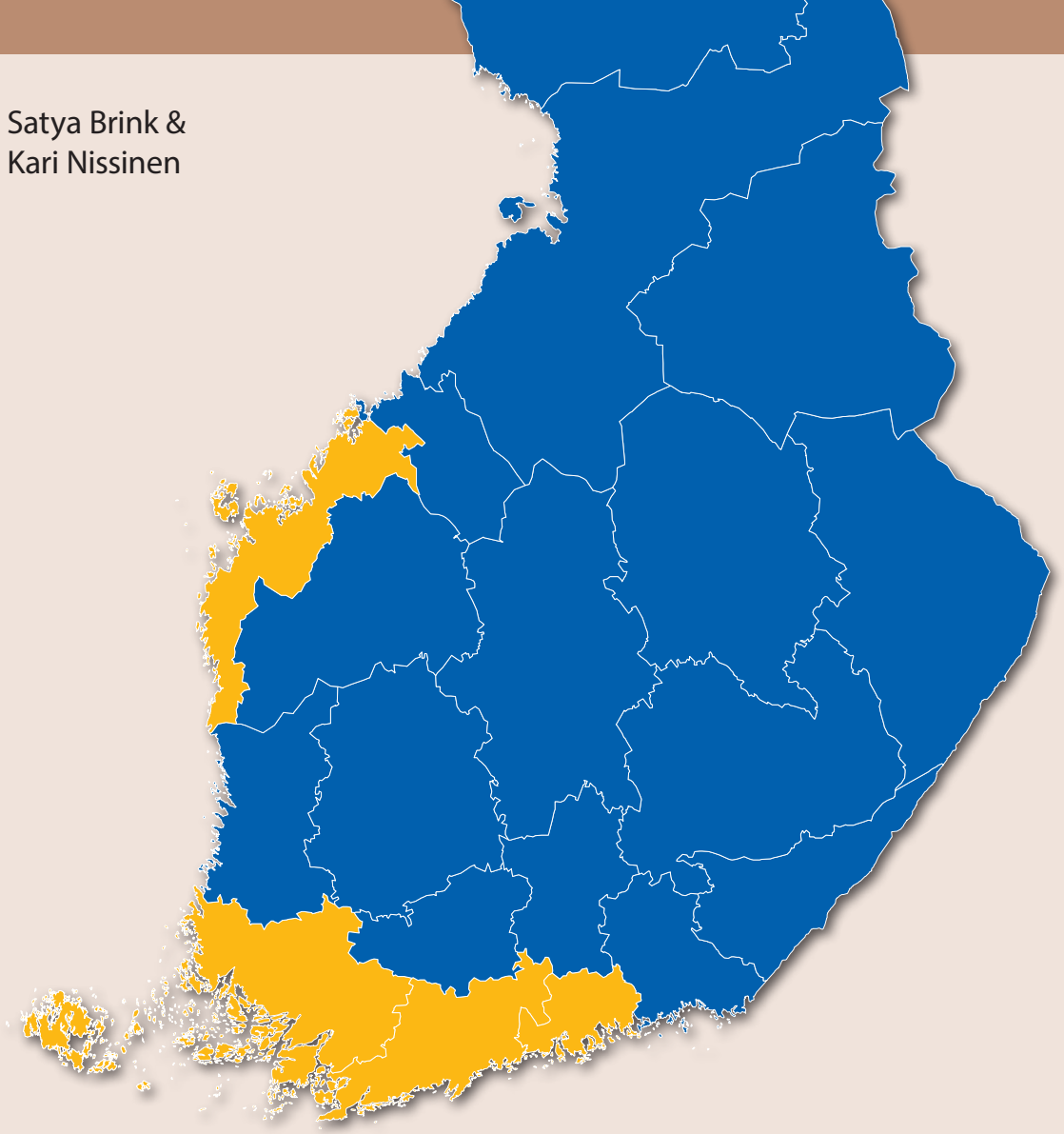
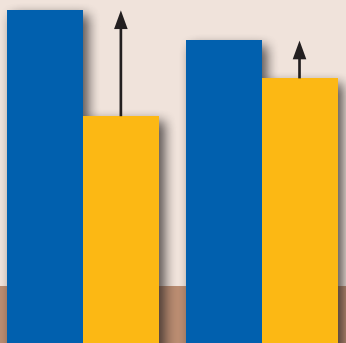
Satya Brink &
Kari Nissinen



Challenge for equity and excellence

Evidence for future successful action in bilingual Finland



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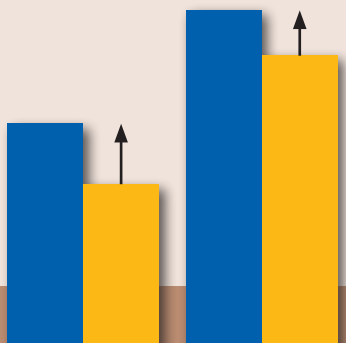

The challenge for equity and excellence in bilingual Finland

Evidence for future successful action

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Evidence for future successful action

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Abstract

In 2013, the authors prepared a report on educational excellence and equity in Finland based on PISA 2009 data and asked the question "Could Finland achieve both excellence and equality goals in the coming decade? Five years later, this report re-examines the challenge faced by Finland in light of recent PISA results.

The Finnish school system, both the Finnish and Swedish speaking components, have consistently ranked at the top of the list of OECD countries. However, Finland's performance has been dropping compared to previous years, while it failed to keep pace with performance improvements in other countries. Simply working harder along the same path will no longer work. Therefore, this report examines of evidence from PISA 2015 in context, to provide some insights for successful action by those involved in education in order to slow and eventually reverse the decline in student performance.

The context in which Finland's comprehensive schooling operates has changed: the numbers of students of school age are declining; there are more foreign language speakers than Swedish speakers in the population; and there have been Swedish school closures and amalgamations. There have been positive changes, too, such as the pioneering new curriculum.

Suggestions are made for strategic action arising from analyses of PISA 2000 to 2015. A series of analyses on student performance over PISA cycles since 2000 in science, reading and mathematics show that there has been a decreasing gap between the average performance of students in Finnish speaking schools and students in Swedish speaking schools. The way this reduction was achieved is not sustainable because students in Finnish speaking schools declined in their performance and students in Swedish speaking schools who had a lower average to start with did not improve much. Thus, increased equality was gained at the expense of excellence. In general, science was the domain with the best per-

formance and Swedish speaking students performed better in mathematics while Finnish speaking students had a higher average in reading in PISA 2015. It is time for Finland to compare performance with top performers wherever they may be and not just among OECD countries. In its heyday, Finland had scores that were similar to those of the top performer Singapore in 2015 and it should be able to achieve those scores again. Analyses of high and low performers, boys and girls and their social background also showed areas where steps can be taken to reduce risk of low scores, to respond early to low performance through monitoring and to provide both opportunities for academic and personal development. Suggestions were made for Finland to work at improving average scores all three domains to achieve higher average scores with less difference between students and schools, particularly through individualized teaching and planning for effective use of additional resources when needed. There were positive signs that both Finnish and Swedish speaking students continue to learn into young adulthood after their comprehensive schooling. The importance of coordinated approaches involving the Ministry of education, municipalities, schools, teachers and parents were highlighted for optimum results. Both excellence and equity should be the goals of education in the coming decade without sacrificing one for the other.

Keywords: PISA 2015, Finland comprehensive education, Swedish speaking schools

Introduction

The primary objective of Finnish education is to provide all citizens with equal access to education (Finnish National Agency for Education, 2017). Like most developed countries, the goal is to give every child the knowledge and skills to access future learning and opportunities throughout the lifetime. Such an education policy supports national growth and prosperity by ensuring high quality education with excellent learning outcomes for every student. These high learning outcomes which are expected to be fair, inclusive and equal confer an "educational advantage" on individuals which they use for the roles they play in society through their lives.

Excellence in education is a prerequisite for continued equal opportunities for individuals and advantageous economic growth for the country. Therefore, in the competitive world that future students will face, excellence cannot be ignored. Finland has not formally enshrined the notion of excellence, but their top rank in the early PISA results awakened the ambition to maintain that standing. An overemphasis on equality can undermine the goal of excellence because equity can be achieved at a lower average level of performance while an over focus on excellence can result in an advantaged segment and greater inequality in overall performance. Furthermore, both excellence and equity must be achieved in a global context. Besides, the top rank and status as a high performing country can only be maintained by improving educational performance at a rate that keeps pace with the world's other best performing countries. For instance, Korea and Hong Kong had lower performance in 2000 but had caught up to Finland by 2009 (OECD, 2010b).

Educational reforms, improved teaching and learning strategies have made Finland a repeated leader in education performance. However, its performance has been slipping. This raises the issue of what strategic actions can be taken to achieve national educational goals as well as top international standing. Simply working harder will not work. Nor

will continuing along the same path. Strategies must be commensurate with the rise in the demands for higher quality of education and for increased student performance. An examination of evidence can provide some insights for successful action.

Aim of this report

This report is based on analysis of Finnish data from PISA 2015. The Programme for International Student Assessment (PISA) is an international survey, conducted every three years under the aegis of the Organisation for Economic Co-operation and Development (OECD) by participating countries, which aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students. Approximately 540 000 students were assessed in 2015, representing about 29 million 15-year-olds in the schools of the 72 participating countries and economies. PISA assesses the extent to which 15-year-old students, near the end of their compulsory education, have acquired key knowledge and skills that are essential for full participation in modern societies. The assessment focuses on the core school subjects of science, reading and mathematics. In 2015, the main focus of PISA was on science but the other two domains were also tested along with the new competence of collaborative problem solving. Finland has participated in all PISA assessments since 2000. In 2015, Finland had a national sample of students but students in Swedish speaking schools were not oversampled as in some previous years.

Many reports on PISA data do not consider the demographic and social context of the analyses which really affect the potential strategies which will be acceptable to the country, the schools, parents and teachers. Generic prescriptions are not as effective as those customized for Finland.

In addition, published research results are often reported to inform and to advance knowledge, leaving the interpretation to those who voluntarily accept this role. Research reports are often not followed by national discussion, which results in policy implementation with coordinated strategic actions by those involved in education.

There are three aims.

- To provide a brief description of the context in which the Finnish education system will have to implement strategies to respond to results from PISA 2015. Finland has changed in the past decade and a half during which the country has participated in PISA. Earlier strategies may need to be amended and allotment of expenditures for education may need to be monitored in relation to outcomes.
- To examine the performance of students in Swedish speaking schools and Finnish speaking schools to determine the areas of weakness and strength, so as to determine where improvements will result in greater excellence and equity.
- To reduce the time between analysis and implementation of strategies for improved outcomes. The research analyses were policy and action-oriented in order to provide direction and practical suggestions for strategic action arising from the evidence.

Context

Before delineating the challenges for excellent and equitable education for bilingual countries such as Finland, it is important to consider the context of the particular country at the specified time. This permits the analyses to take into consideration the special characteristics of the country as well as the evolution of its system of education.

Challenges to education arising from the changing population structure

According to Statistics Finland, the population of Finland is 5.5m people in 2017 with a low average population density of 17 persons per km². The growth rate of the population has declined from a high of 1.2% in 1954 to 0.5% in 2017. The age structure is an inverted population pyramid with fewer children and more older people, the number of which is growing more pronounced with time. Table 1 shows how the population of Finland will continue to change with the population share of children of school age continuing to decline.

Table 1. *Population structure of Finland, 2000 projected to 2050.*

	2000	2010	2016	2030	2040	2050
0–14 years	18.1%	16.5%	16.2%	15.3%	14.8%	14.6%
15–64 years	66.9%	66.0%	62.9%	59.1%	58.9%	58.1%
65 and over	15.0%	17.5%	20.9%	25.6%	26.3%	27.3%

Source: Statistics Finland

This future shift in the population structure will likely affect the allocation among public social expenditures, including expenditures for education. While there may be a decline in the population of children requiring education, it can be claimed that the shrinking future labour force raises the importance of education in order to increase productivity and com-

petitiveness. It can also be argued that basic education has to serve Finnish citizens for the 60 years or more following compulsory school. Excellence and equity are also important because older people are working beyond the traditional age of retirement or are engaged in volunteer work or the social economy.

Figure 1 shows that public expenditure for total education rose between 2000 and 2010, plateaued and declined very slightly until 2015. The future rate of decline will depend on the competing social expenditure pressures.

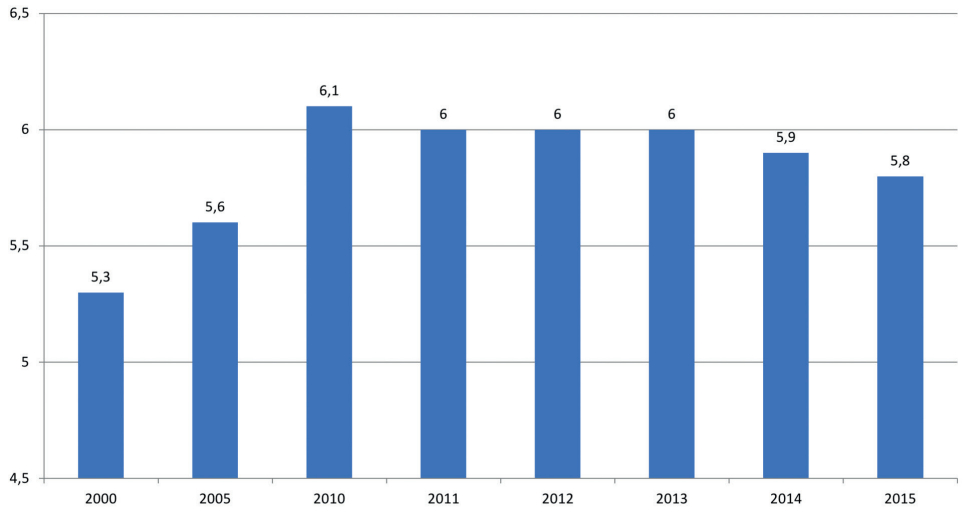


Figure 1. *Expenditure of regular education expenses as the share of GDP in Finland: 2000 to 2015.* Source: Statista.com

So far, Finland has maintained the priority for comprehensive education as demonstrated by a fairly stable share of GDP dedicated to primary and post-secondary education since 1995. According to Statistics Finland, there were 2 384 active comprehensive schools with 556 700 students in 2017.

If the number of children in the population declines, then the number and distribution of schools are also likely to change. The various levels of government will be obliged to consider the budget allocation for education. Rising costs and inflation could also affect expenditures. Table 2 shows that Finnish expenditure for primary to post-secondary education as a percentage of GDP has continued to be stable.

Table 2. *Expenditure as % of GDP for primary to post-secondary non-tertiary education, Finland 1995–2014.*

1995	2000	2006	2008	2009	2010	2011	2012	2013	2014
3.9	3.5	3.7	3.6	3.9	3.9	3.9	3.9	3.9	3.9

Source: OECD

Challenges to education arising from evolving population composition

Immigration has changed the population composition of Finland. The numbers of people in Finland who speak a foreign language has increased rapidly in the last decade. Figure 2 shows that in 2000 when PISA was first implemented there were about 100 000 foreign speakers. By 2015, that number had risen to over 300 000.

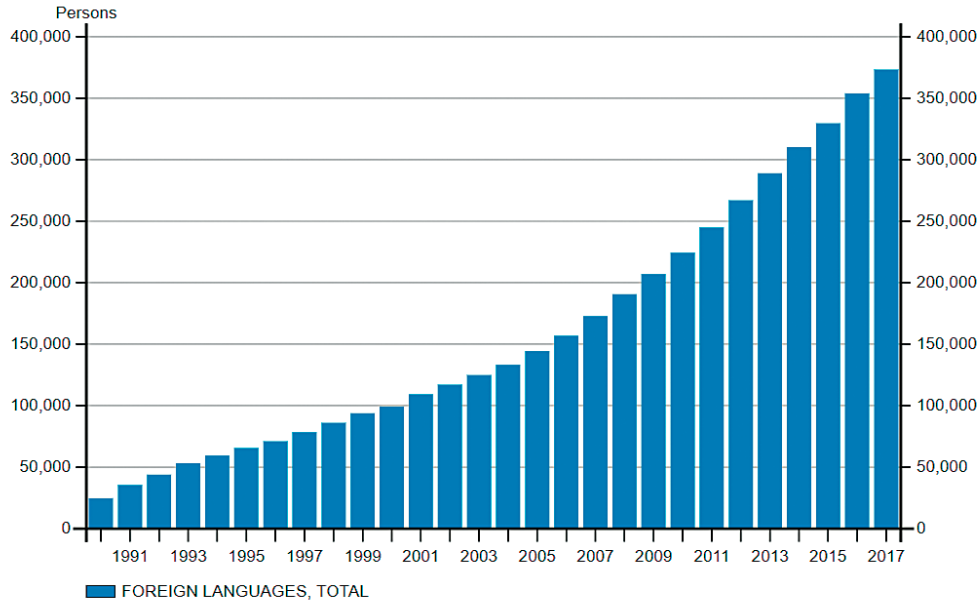


Figure 2. *Number of persons speaking a foreign language in the population, Finland 1990–2017.* Source: Statistics Finland

Because the growth in the population speaking a foreign language has been so rapid in the last decade and because the Swedish minority in Finland has been declining over time and only stabilising in the last few decades, the percentage of foreign speakers has recently superseded the proportion of Swedish speakers (Figure 3).

When opportunities present themselves, there is competition among citizens whether for education, services or jobs and such competition will no longer only be between the minority Swedish speakers and the majority Finnish speakers but also with other minorities. National minority status is usually protected by law; however, it provides no protection against competition for opportunities or their benefits. The fair distribution of results within and between each population group will affect the inequality in the country and greater success of one group over the others could result in elite and disadvantaged groups. Therefore, not only equal access to education but also equity of learning outcomes rise in importance.

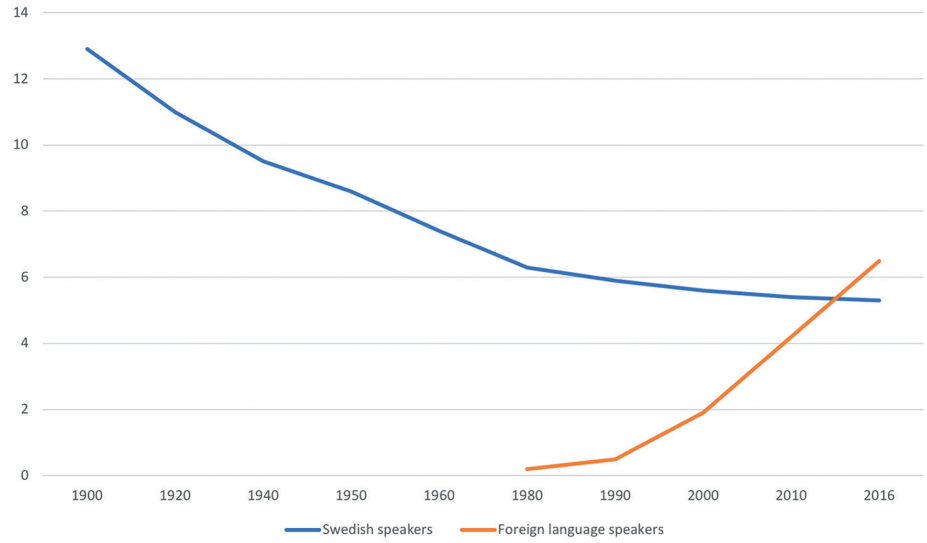


Figure 3. *The percentages of foreign language speakers and Swedish speakers, Finland 1990–2016.* Source: Karlsson, 2017

In almost all the regions of Finland, with the exception of the Åland Islands, Ostrobothnia and Central Ostrobothnia, foreign language speakers exceed Swedish speakers (Table 3).

Table 3. *The number of Finnish, Swedish and foreign language speakers in the regions of Finland as in December 31, 2017.*

Regions	Finnish speaking	Swedish speaking	Foreign language speaking
Uusimaa	1 313 936	131 770	209 785
Varsinais-Suomi	418 099	27 137	32 416
Satakunta	212 344	779	7 273
Kanta-Häme	165 143	633	6 935
Pirkanmaa	486 090	1 957	24 007
Päijät-Häme	190 417	693	10 097
Kymenlaakso	163 881	1 329	10 298
South Karelia	121 923	226	7 714
Etelä-Savo	142 286	234	4 674
Pohjois-Savo	239 297	244	7 104
North Karelia	156 841	141	5 999
Central Finland	266 610	457	8 939
South Ostrobothnia	186 379	569	3 957
Ostrobothnia	79 530	89 669	11 736

Central Ostrobothnia	60 582	6 212	1 985
North Ostrobothnia	399 788	788	11 127
Kainuu	71 831	73	2 052
Lapland	172 386	438	4 839
Åland	1 398	25 703	2 388

Source: Statistics Finland

More than the percentage of the population that minorities represent, it is the rate of benefiting from opportunities that they encounter in life that promotes thriving in a cohesive society and that protects against marginalization. National and municipal government can ensure fairness through equitable and excellent outcomes of education so that all citizens in Finland are assured of success in the face of global competition.

Challenges due to changes in the number and distribution of Finnish and Swedish schools

The fact that there are changes in the number and distribution of schools in Finland is to be expected. Table 1 showed that the population of school age children had a slow downward trend. Both the number and distribution should be considered in terms of three factors. First, that the children affected were not impacted in the excellence and equity of their outcomes. Second, that Swedish schools did not bear the brunt of closures or amalgamations so that Swedish children experienced a greater impact or had a lower chance that their outcomes equal those of students in the larger Finnish education system. Third, that children living in rural areas were not unfairly disadvantaged compared to children living in more densely populated areas. For instance, on average across OECD PISA countries, students who attend schools in cities of more than 100 000 people perform better than students who attend schools in villages, rural areas, or towns with up to 100 000 inhabitants. This difference in performance translates to about 20 PISA score points – the equivalent of half-a-year of schooling.

According to Statistics Finland, there were 2 384 active comprehensive schools with about 556 700 students, 49 per cent girls and 51 per cent boys, in 2017 (Table 4). The number of pupils in comprehensive schools actually increased by 1.2 per cent from the year before, though there were 65 schools fewer than the year before. Municipalities ran 95 per cent of these comprehensive schools (Statistics Finland, 2018). Between 2015 and 2016 only 3 Swedish schools were closed according to Yle Nyheter (23.3.2017)

Table 4. *Number of comprehensive schools and students by region and population density, Finland 2017.*

Region	Active comprehensive schools	Pupils total	Population density per square km
Whole country, total	2 384	556 742	18.0
Mainland Finland, total	2 361	553 852	18.0
Uusimaa	538	165 398	178.1
Varsinais-Suomi	211	44 787	44.5
Satakunta	115	21 303	28.5
Kanta-Häme	87	17 748	33.6
Pirkanmaa	175	52 251	40.2
Päijät-Häme	70	19 333	39.3
Kymenlaakso	84	16 084	34.7
South Karelia	39	11 546	24.6
Etelä-Savo	76	12 788	10.5
Pohjois-Savo	115	23 429	14.8
North Karelia	72	14 609	9.3
Central Finland	113	28 174	16.5
South Ostrobothnia	134	21 186	14.3
Ostrobothnia	127	19 922	23.4
Central Ostrobothnia	55	8 116	13.8
North Ostrobothnia	215	53 193	11.1
Kainuu	34	6 833	3.7
Lapland	101	17 152	2.0
Åland	23	2 890	18.7

Source: Statistics Finland

The closure of schools implies that students are provided their education in other schools that may be larger, further away or both. Statistics Finland states that 19 per cent of comprehensive schools were joint schools with grades 1 to 9 and the share of such schools grew by 10 percentage points in ten years (Figure 4). In ten years, the number of primary schools comprising grades 1 to 6 went down by 31 per cent, while the number of joint schools has grown by 56 per cent. In 2008, there were 2 300 primary schools, while in 2017 the corresponding figure was 1 589.

The Swedish-language schools are mainly located in the coastal areas and a few Swedish-language schools can also be found in the so called "språköarna" (language islands). (Figure 5)

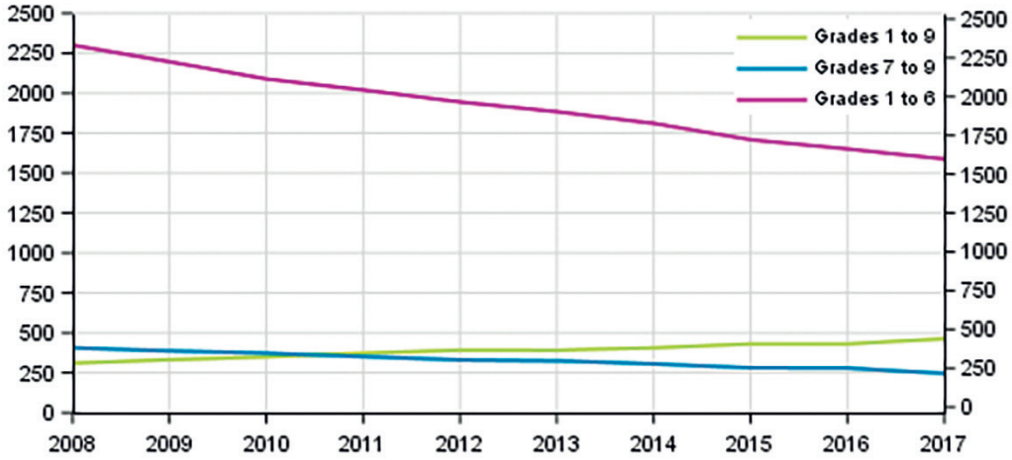


Figure 4. *Number of comprehensive schools by grades, Finland 2008–2017.* Source: Statistics Finland

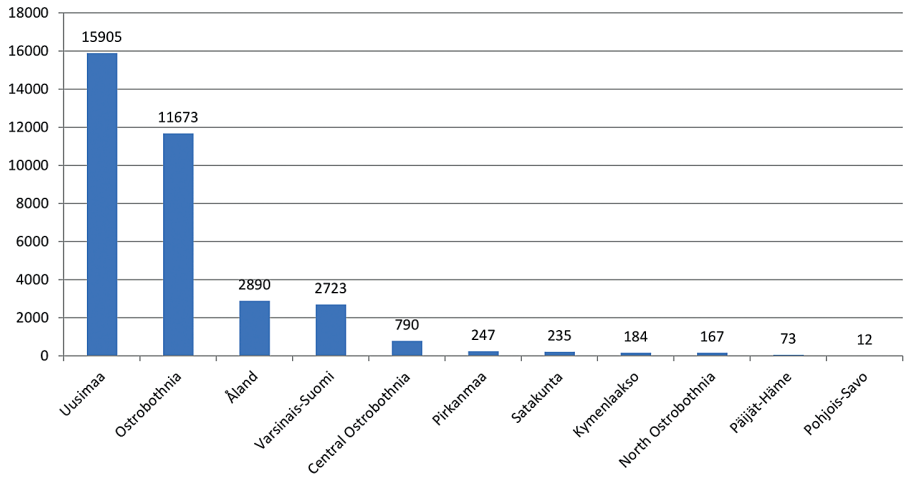


Figure 5. *The number of Swedish students in comprehensive schools in the regions of Finland.* Source: Statista.com

The pattern of closures was likely the same among Swedish schools. According to a news article in 2005, there were 304 basic Swedish schools which declined in 2017 to 247. Statistics Finland reports that there are now 57 fewer schools in Swedish Finland. The municipalities that had closed the most schools were Borgå (population 50 203, population density 76.7 per km2, 2018), Kristinestad (population 6 671, population density 9.8 per km2, 2018), Kimitoön (population 6 823, population density 9.9 per km2, 2018) and Närpes (population 9 502, population density 9.7 per km2, 2017). Närpes has been a bilingual municipality since 2016. Before that Närpes was the last unilingually Swedish speaking municipality in continental Finland. (Figure 6)

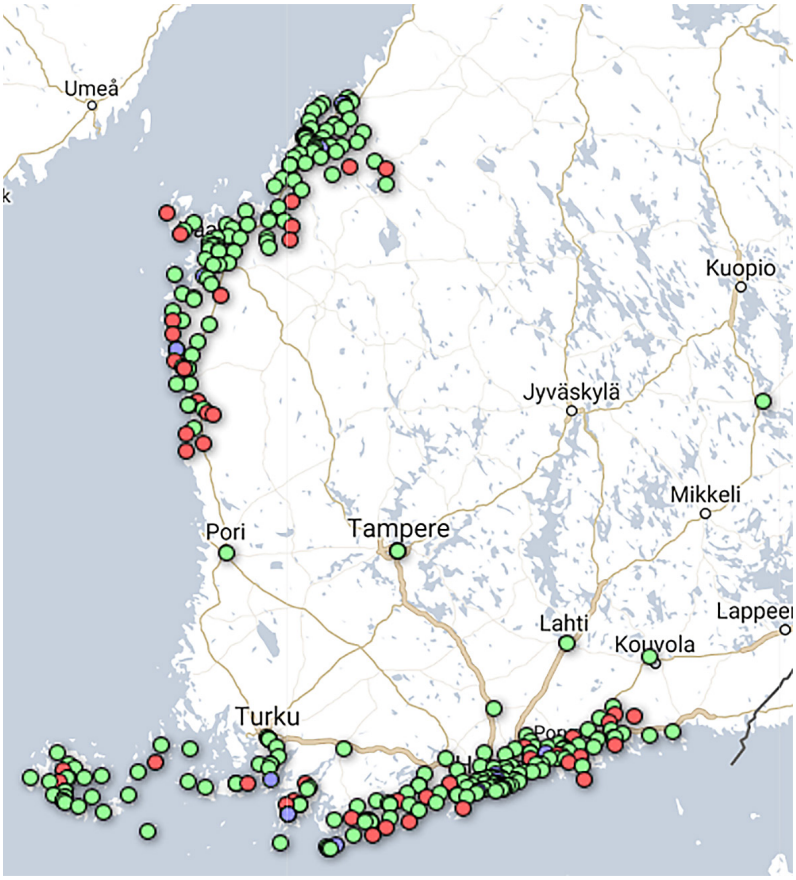


Figure 6. *Current Swedish schools, school closures and amalgamations in Finland 2017. The green dots identify current Swedish schools, red dots the school closures and the blue dots amalgamations.* Source: Yle nyheter 23.3.2017

Closing schools is politically unpopular as schools in many communities play a major social and cultural role (Autti & Hyry-Beihammer, 2014). However, most of the time, an economic rationale is provided for the closure and the central role of schools in communities does not affect the decision. In general, in Swedish Finland, it was usually schools with fewer than 50 students that were closed. (Figure 7)

As a consequence, more schools were larger and students may need to travel longer distances to their school while school choice was reduced. Larger schools could have some positive characteristics. Larger schools tend to have a more socio-economically advantaged student body, enjoy greater responsibility for resource allocation, are less likely to experience staff shortages, are more likely to have a higher proportion of qualified teachers, and have higher student-teacher ratios than schools in rural areas and towns, especially in partner countries and economies (OECD, 2013). Students learn in an environment with larger social networks with greater diversity.

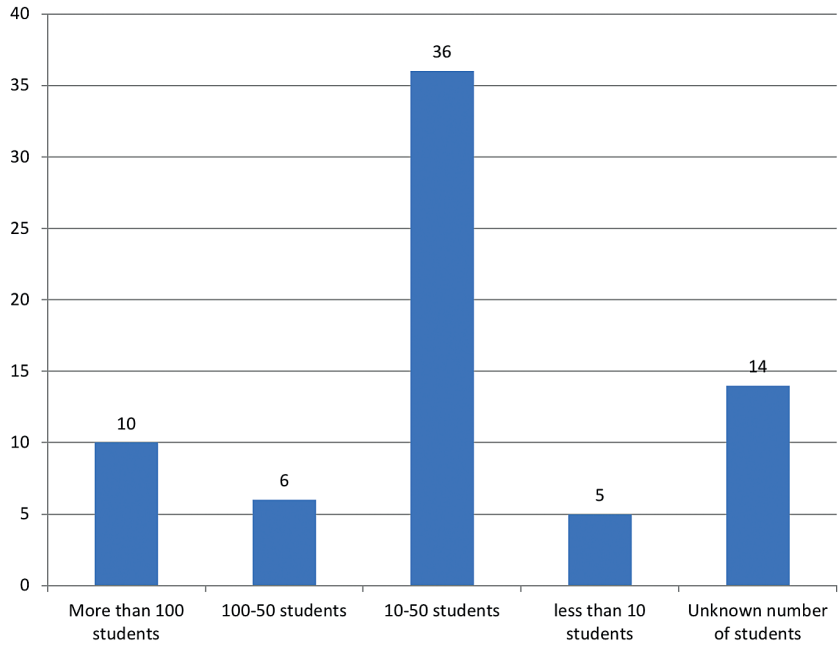


Figure 7. *The size of Swedish schools that were closed in Finland.* Source: Yle nyheter 23.3.2017

Some future issues

Education policy evolution and the impact of the new curriculum and other potential changes

Finland has relied largely on universal policies for education and emphasized equal access (Table 5). It would be well worth looking at time-limited targeted policies that could be responsive to current conditions. (There are precedents. For example, extra funding for immigrant preparation.) For instance, additional funding could be available for every very low performing student in a region, so that individualized teaching can be provided for them in their schools.

Table 5. *Education policy trajectory in Finland.*

1960s	1968	Basic Education Act
1970s	1970	Framework curriculum
	1972	Basic school reform of 9 year compulsory education for all
	1972	Teacher Education Act
	1973	Day Care Act
1980s	1985	Framework curriculum
	1985	Streaming abolished
	1986– 1991–	Decentralization
1990s	1992	Finland signed European Charter for Minority Languages
	1994	Framework curriculum
	1991–1999	Polytechnic reform
	1998	Basic Education Act Comprehensive school reform

2000s	2004	Framework curriculum
	2006	Report to Parliament on application of Language Act
	2009	32 Municipal mergers
	2009	Report to Parliament on application of Language Act
	2007–2010	Project- National languages: Position of the second language
2010s	2016	Framework curriculum

Source: Brink, Nissinen and Vettenranta, 2013 (updated)

There have been curriculum changes roughly every ten years. At present knowledge is increasing at a fast rate, particularly in science and ICT, so it may be useful to look at ways for updating the curriculum in between major reform.

There are three initiatives related to the new curriculum that can have a future impact.

The new national core curriculum is a framework that spells out the pedagogy and learning that is expected from schools in Finland. Schools in municipalities develop their own school curriculum in compliance with the national core curriculum. Or municipalities could also develop a curriculum based on the core which their schools will adapt for their use.

The core curriculum was first applied in 2016, so PISA 2015 could not capture the base line which can be compared with the results in 2018 when the curriculum has been in force for a couple of years. The core curriculum is an innovative departure from the traditional, driven by a pedagogical vision of the desired set of cross-subject or transversal competencies that teachers will develop in all students at school through all learning activities. These epitomize the aims of Finnish education and reflect the competences needed in all spheres of life.

These competencies are:

- Thinking and learning to learn
- Cultural literacy, interaction, and expression
- Taking care of oneself, everyday life skills, safety
- Multi-literacy
- Digital competence
- Working life skills and entrepreneurship
- Participation, influence, and responsibility for a sustainable future.

In addition, to increase the relevance, integration and dialogue between the subjects, a new multidisciplinary learning module was introduced once every school year, on a meaningful theme which will be based on discovery and self-direction. The aim is that pupils will

- understand the relationship and interdependencies between different learning contents
- be able to combine the knowledge and skills provided by different subjects to form meaningful wholes
- be able to adopt and use these in collaborative learning.

The third is to enhance the use of tools that students will use in their lives after school. The Finnish Matriculation Examination at the end of the high school years will be digital, a process started in 2016 and completed by 2019. During this long lead time schools should prepare students to ensure that they can demonstrate their learning without being hampered by the digital method of taking the exam.

Though PISA 2018 will be only a few years after the implementation of the new curriculum, it will be valuable to examine the impact on not only the outcomes of reading, mathematics, science, problem solving and digital skills but also its influence on learning strategies.

A new discussion has been launched on extending the years of compulsory education beyond nine years. It is considered a means of assuring more and better educated high school graduates and potential entrants to higher education.

Equity gains under threat

Finnish education is based on the principle that the nation must provide equal access to quality education and training to every citizen. The same educational opportunities should be available to all irrespective of their ethnic origin, age, wealth or location (Finnish National agency for education, 2017).

Results from the very first PISA in 2000 point out that equity was an important driver of the high performance of Finnish students. Finland had exceptional results in three measures of equity: equality of performance outcomes, equity of outcomes among socioeconomic levels and equality of access to high quality education regardless of location. Finland had the lowest gap between high and low performers in reading literacy. Socioeconomic background had a low impact on outcomes and even those in the lowest socioeconomic quartile scored above the OECD average. Furthermore, only 5 per cent of the variation was between schools, the smallest among the OECD countries. However, the gender gap was the widest because girls did exceptionally well in reading but boys also did well, scoring above the OECD average (Välijärvi et al., 2002)

Since then, Finnish researchers working with later waves of PISA have found worrying symptoms of inequality. Some examples are provided below.

By 2009, there was a marked and uneven decline in reading scores when the average performance dropped by 25 points (half a school year) within a decade and the performance gap between the highest and lowest student deciles grew by 25 score points in the last decade. (Kupari et al., 2013)

The bottom 10 per cent of Finnish schools declined more steeply than most schools. A group of schools had dropped even below the OECD average. (Kupari et al. 2013)

While socioeconomic background generally accounts for 8 to 11 percent of between-student variation in the national and international assessments, as much as 80 percent of

the variation between schools can be accounted for by the students' socioeconomic background. (Kuusela, 2006)

The effect of socio-economic background on individual outcomes was also shown to be growing in Finland, since the statistical effect that a one-unit increase on the socio-economic scale had on student mathematics scores had risen from 28 points to 33 points in PISA 2012, and the difference between the lowest and highest socioeconomic quartiles grew by 6 score points (Kupari et al. 2013). In PISA 2015, the effect of socio-economic background on PISA scores exceeded the OECD average for the first time in Finnish PISA history. A one-unit increase on the socio-economic scale corresponded to an increase of 41 points on scientific literacy in Finland, while the OECD average was 39 points (Vettenranta et al., 2016). Using future PISA data, this trend should continue to be monitored.

Regional and urban-rural equality of access may be more easily provided than equity of outcomes. In 2009, girls in Northern Finland had an average of 580 score points in PISA reading, while boys in Eastern Finland scored about 100 points less, a difference which corresponded to more than 2 years of schooling (Harju-Luukkainen et. al. 2016).

It is also ironic that a broad definition of equity is suggested in the Finnish principle of equity, but gender and language minority are not mentioned and it is these two areas where inequity has been most persistent.

Analyses, evidence and suggestions for strategic action

The last PISA assessment was conducted in 2015 with science as the major domain. The following analyses and discussion will compare the results from waves in which the major domains of science, reading and math were conducted with results in PISA 2015 rather than every PISA cycle. The Finnish performance will be examined in comparison with Canada, Estonia and Korea which are countries of interest. Canada has a bilingual population like Finland and its experiences are of value to the Finnish and Swedish school systems. Estonia is a European country which distinguished itself by its rapid rate of improvement while Korea maintains its high standing in global comparisons. But it is also important to compare Finland's own performance over time to identify priorities for action. In addition, Finland opted to test collaborative problem solving in 2015, so it is possible to report on Finland's performance. In 2015, unlike some earlier years, there was no oversampling of the Swedish speaking students in Finland, which will affect the analysis, however, where possible the performance of the language minority and majority will be compared.

Suggestions for strategic action are directed to the whole education system and where necessary to the Swedish speaking school system, especially because of Finland's declining performance. In examining the results separately by PISA cycle, majority/minority language and location, Finnish priorities, allocations and efforts can be directed to areas of weakness which can be masked by averages. This approach will buttress the national principle of equality in education.

Global performance and Finland's ranking in science, reading and mathematics

If Finland wishes to retain its top ranking in performance, it is reasonable to start by comparing its performance with the top performer in each domain.

The top performer in Science in 2015 was Singapore with an average score of 556, a score that was 63 points higher than the OECD average of 493. Finland ranked fifth with a score of 531, with a gap of 25 points below Singapore which corresponds to over half a year of schooling. It is interesting to note that three Asian countries, Singapore, Japan and China- Taipei scored higher than Finland. The only European country that scored higher than Finland was Estonia. The OECD report (2016, volume 1) also notes that Singapore increased its score by 7 points over 3 years while Finland declined by 11 points.

Singapore ranked first also in reading, with an average score of 535, about 42 points above the OECD average of 493. Finland scored an average of 526, 9 points lower than Singapore and ranked fourth. Canada, Hongkong-China and Singapore ranked higher than Finland. The OECD report (2016, volume 1) points out that Singapore's score rose by 5 points in the 3 year trend while Finland declined by 5 points.

Top scoring Singapore had an average score of 564 points in Mathematics, 74 points above the OECD average of 490. Finland had an average score of 511, 53 points (more than a year of schooling) below Singapore and it ranked thirteenth. Asian countries such as Chinese-Taipei, Chinese-Hongkong, Chinese-Macao, Chinese cities and Japan all scored higher than Finland. According to the OECD report (2016, volume 1), Singapore raised its average score by 1 point over the three years while Finland declined by 10 points. The report also pointed out that among OECD countries one student out of ten was a high performer in mathematics while in Singapore every third student was a high performer.

Suggestions for strategic action

Finland tends to compare itself with OECD member countries. In a globalized world, it is now important to compare performance with top performers wherever they may be. For instance, it only scored 4 points lower than Estonia but it scored 25 points lower than Singapore in science.

It is not necessary to be daunted by the big differences in average scores compared with Singapore. For instance, Singapore had an average score of 556 in science. In 2006, Finland had an average score of 563. If this higher average score could be achieved once, it can surely be achieved again.

The school system is on the right track with its new curriculum proposing that the links between subjects increase understanding. This approach could raise performance in all subjects. Finland had ranks of 5, 4 and 13 in the three domains while Singapore held the

first rank and had high scores in all three. Singapore also had less than 5 per cent of low performers in all three domains.

Asian countries appear to be able to maintain high scores consistently while Finland performs well but does not score as high as the best. It is important to assure students and parents that the school system performs consistently at a high level over time.

Finland's performance over time in science, reading and mathematics

It is important to compare Finland's own performance over time to be able to look at the changes in relation to the context that were discussed earlier.

Science was the major domain in 2006 and those results are compared with performance in 2015. Table 6 shows that in 2006 Finland had an average score of 563, a score that has not been surpassed since that date. Its first rank had fallen to fifth in 2015 and its score declined by 32 points to 531. Among OECD countries, Finland ranked below Japan and Estonia. Canada also declined in rank from 3 to 7 in 2015 but it had a slightly lower (6 points) average score. Estonia's rank rose from 5 to 3 and its average score rose by 3 points to 534. Korea ranked eleventh both times and its average score fell by 6 score points to 516. If the drop in Finland was limited to 6 points like in Canada and Korea, Finland would still rank at the top.

Table 6. *PISA average score and rank in science in 2006 and 2015: Finland, Canada, Estonia and Korea.*

Science	**2006**			**2015**		
	Score	Rank	OECD rank	Score	Rank	OECD rank
Finland	563	1	1	531	5	3
Canada	534	3	2	528	7	4
Estonia	531	5	3	534	3	2
Korea	522	11	8	516	11	5

There were two previous PISA cycles in 2000 and 2009 when reading was the major domain, the results of which are compared to results in 2015. Finland ranked first with an average score of 546 in 2000 which is a higher score than Singapore (535) in 2015. But Finland lost 10 points between each cycle and had an average score of 526 in 2015 and the fourth rank. It ranked second in both 2009 and 2015 among OECD countries. Second ranking country Canada in 2000 also dropped 10 points in 2009 but gained 3 points for an average of 527 and third rank in 2015. Both Estonia and Korea demonstrated that it was possible to gain more than 10 points in 3 years. Both countries had a similar average score and ranked sixth and seventh in 2015. Korea lost 22 score points between 2009 and 2015 (Table 7).

Table 7. *PISA average score and rank in reading in 2000, 2009 and 2015: Finland, Canada, Estonia and Korea.*

Reading	2000			2009			2015		
	Score	Rank	OECD rank	Score	Rank	OECD rank	Score	Rank	OECD rank
Finland	546	1	1	536	3	2	526	4	2
Canada	534	2	2	524	6	3	527	3	1
Estonia				501	13	10	519	6	4
Korea	525	6	6	539	2	1	517	7	5

Mathematics was the major domain in 2003 and 2012 and those results are compared with performance in 2015. Among OECD countries, Finland ranked first in 2003 with an average score of 544. In 2015, Singapore was first with an average score of 564 which is 20 points higher (about half a school year). In 2012, when the Asian countries first participated in PISA, Finland ranked 12 with an average score of 519 which was 25 points lower than in 2003. In 2015, the average mathematics score was 511, a further drop of 8 points and Finland ranked 13. Canada's average score fell from 532 to 518 dropping 14 points and its rank went from 7 to 13. Korea gained 12 points to reach a score 554 in 2012 but its rank still fell from third to fifth. But, in 2015 Korea's average score was 524, 30 points less and its rank fell to seventh. Estonia maintained its score between 2012 and 2015 and its rank rose from 5 to 7 (Table 8).

Table 8. *PISA average score and rank in mathematics in 2003, 2012 and 2015: Finland, Canada, Estonia and Korea.*

Mathematics	2003			2012			2015		
	score	rank	OECD rank	score	rank	OECD rank	score	rank	OECD rank
Finland	544	2	1	519	12	6	511	13	8
Canada	532	7	5	518	13	7	516	10	5
Estonia				521	11	5	520	9	4
Korea	542	3	2	554	5	1	524	7	2

Collaborative problem solving was assessed for the first time in 2015. The average scores for all four comparison countries were very close, with just 4 points separating them, though ranks varied from 4 to 7. Finland has the opportunity to improve further in this domain in the future since it had the lowest rank of the four comparator countries (Table 9).

Table 9. *PISA average score and rank in collaborative problem solving 2015: Finland, Canada, Estonia and Korea.*

Collaborative problem solving	2015		
	Score	Rank	OECD rank
Finland	534	7	5
Canada	535	5	3
Estonia	535	6	4
Korea	538	4	2

Suggestions for Strategic Action

Finland has had the highest average scores in science and reading, so it is definitely possible to excel in those two domains again, so long as the school infrastructure, teaching quality and resource distribution is maintained. As it is clear from the experience in all four countries, it is easier to drop a lot of points than to gain them. Consistent performance is the key.

Collaborative problem solving is a new domain but it is an important skill for a successful future in the labour market. This is a skill which can be developed very well through the multidisciplinary module and so Finland has an advantage over other countries which do not have such a pedagogical mechanism.

Of the three domains, Finland is weakest in mathematics though it is still a high-ranking country (Figure 8).

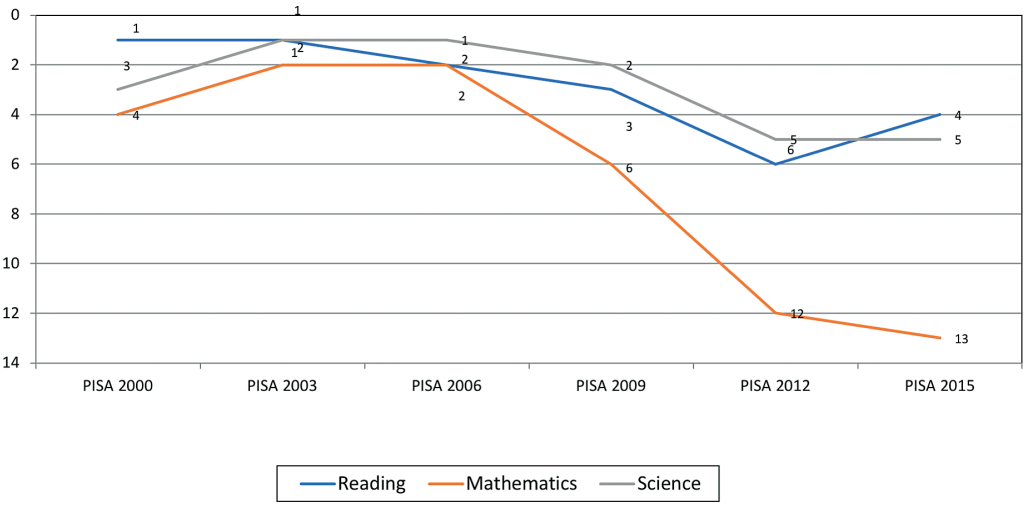


Figure 8. *Finland's ranks in the three domains 2000–2015.*

Mathematics is a domain where other countries were improving at a faster pace than Finland. It would have been better if remedial action for improving mathematics performance had been taken after PISA 2009 but it is not too late to turn performance around. Improved teaching and learning in Mathematics should be a priority to ensure both excellence and equity.

Distribution of scores in PISA levels

PISA scores are classified by difficulty of the tasks into a scale with 8 levels – from the top level 6 to levels 1a and 1b and below 1 at the lower end (Appendix 1). The skew of the distribution of scores among higher levels is desirable which means that there are more high performing students. The peak level indicates where most of the scores of a country fell. The Finnish distribution is compared with that of Singapore, the highest scoring country.

In science, both Finland and Singapore had more high performing students than low performing students. However, the peak for Singapore was in level 4 while the peak for Finland was in level 3. Singapore also had a higher percentage of scores in levels 6, 5 and 4 while Finland has a higher percentage of scores in levels 3, 2 and 1b (Figure 9).

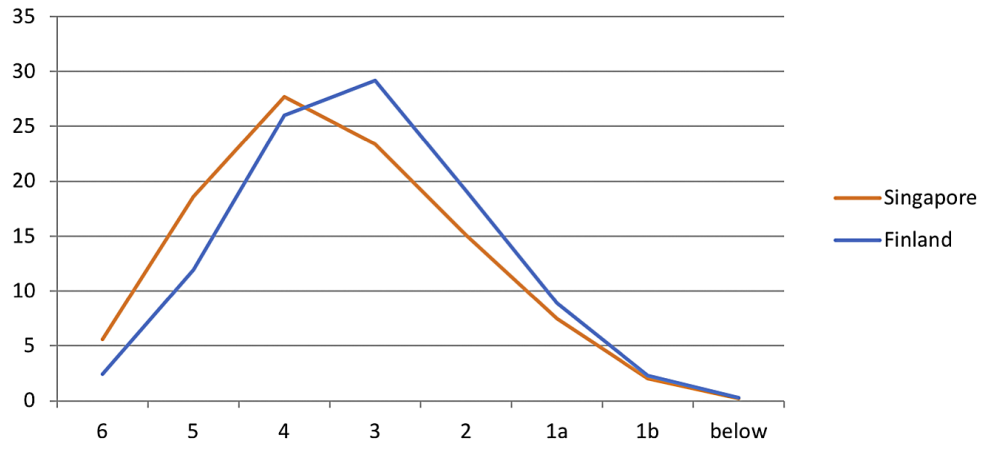


Figure 9. *Comparison of the distribution of science scores by PISA levels in Finland and Singapore.*

There was hardly any difference in the distribution of reading scores in levels 2, 1a, 1b and below between Finland and Singapore (Figure 10). However, Finland had a higher percentage of scores in level 3 while Singapore peaked at level 4. Singapore also had more high performing students in levels 5 and 6 but the difference between Finland and Singapore was not as great as in science.

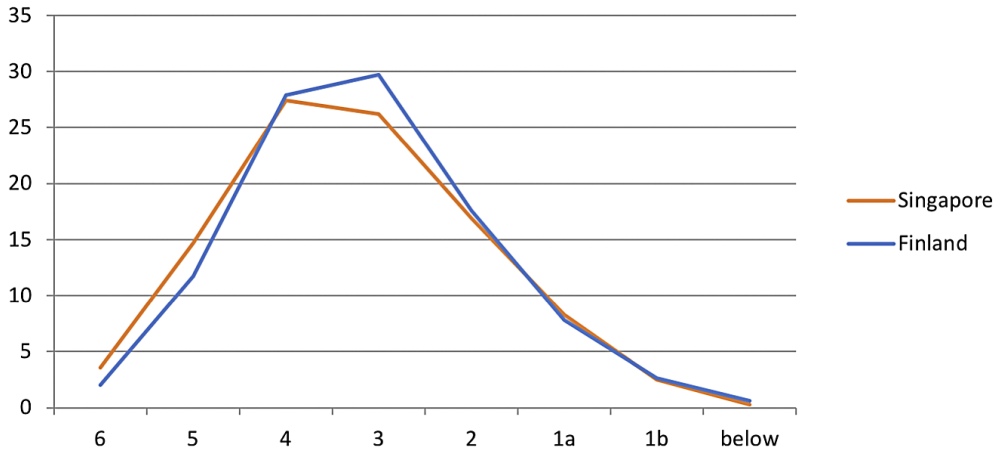


Figure 10. *Comparison of the distribution of reading scores by PISA levels in Finland and Singapore.*

The higher performance of Singapore students in mathematics was clear as there were much higher percentages of students in levels 5 and 6, compared to Finland (Figure 11). Finland has higher proportions of students in levels 3, 2, 1 and below 1. The proportion of scores in level 4 was almost equal but Singapore peaks at level 4 while Finland peaks at level 3.

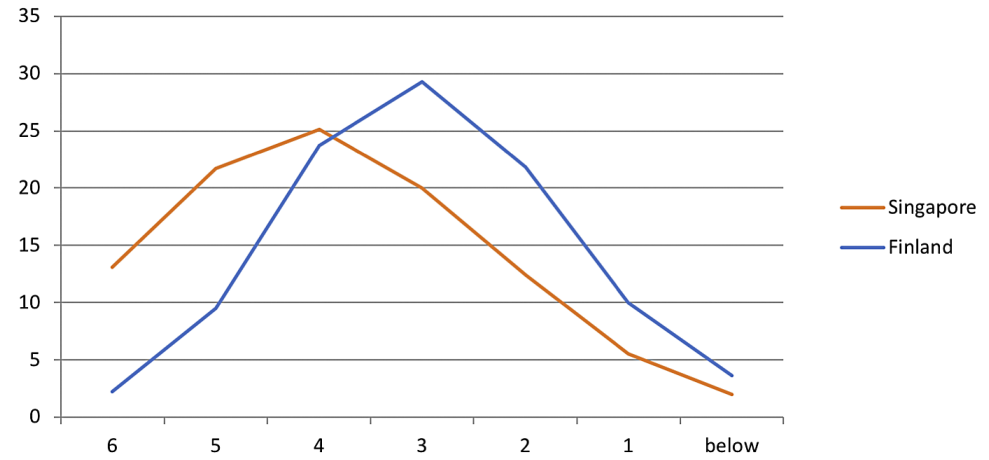


Figure 11. *Comparison of the distribution of mathematics scores by PISA levels in Finland and Singapore.*

Suggestions for strategic action

To be the top scoring country, it seems to require a peak at level 4 in all 3 domains. The distribution is most different from top scoring Singapore in the domain of mathematics where efforts must be made in Finland to shift the distribution to higher performance levels, by reducing the percentage of low performers and increasing the proportion of high scorers.

The performance of students in Swedish and Finnish speaking schools

Excellence and equality should both be achieved without sacrificing one for the other. Since 2000, there has been a difference in the performance of students in Swedish and Finnish speaking schools. Therefore, it is important to have a closer look at their performance over time in Finland. However, since the Swedish speaking schools were not oversampled in 2000, 2006 and 2015, the results for these years must be viewed with caution as they are only indicative.

In PISA 2006, students in Finnish speaking schools outscored students in Swedish speaking schools in science with a difference of 34 points – a difference which was statistically significant (Table 10). In 2015, the scores of both Swedish speaking and Finnish speaking students declined, however the drop was clearly higher for Finnish speaking students. It is notable that the average science score for Finnish students (565) was higher in 2006 than the score of Singapore (556) in 2015! The overall decline in Finland's performance was due to the greater decline (about 34 points) in performance of Finnish speaking students than that of Swedish speaking students (about 8 points). The difference between students in Finnish and Swedish speaking schools was not significant in 2015.

Table 10. *The performance of students in science in Swedish and Finnish speaking schools over time.*

Science	2006			2015			Change 2006–2015
	n	mean	s.e.	n	mean	s.e.	
Finnish speaking	4413	564.9	2.1	5534	531.2	2.6	-33.7***
Swedish speaking	301	530.7	6.2	348	522.3	7.1	-8.4
FIN-SWE difference		34.2***			8.9		

*** p < 0.001; ** p < 0.01; * p < 0.05

The average scores of Finnish speaking students in reading in 2000 (548) and in 2009 (538) were higher than the average score (535) of Singapore in 2015 (Table 11). However, the Finnish speaking performance in reading fell by statistically significant 21 points between 2009 and 2015. The reading scores for the Swedish speaking students held steady between 2000 and 2009 and declined only by about 6 points (not significant). However, the difference in the average reading score of Finnish speaking and Swedish speaking students

was highest in 2000 (36 points) and lowest in 2015 (22 points) but the difference continues to be worrisome because it equates to about half a school year. The difference between the average reading scores of the students in Finnish speaking schools and the students in Swedish speaking schools declined, more due to the falling average scores of the former so the move towards equality was at the expense of excellence. The decline in the average scores of Finnish speaking students also probably contributed more to the overall decline in Finland's performance than that of Swedish speaking students.

Table 11. *The performance of students in reading in Swedish and Finnish speaking schools over time.*

Reading	2000			2009			2015			Change 2000–2015	Change 2009–2015
	n	mean	s.e.	n	mean	s.e.	n	mean	s.e.		
Finnish-speaking	4622	548.3	2.6	4403	537.5	2.4	5534	527.8	2.7	-20.5**	-9.7
Swedish-speaking	242	512.7	13.6	1407	511.4	2.6	348	505.5	7.4	-7.2	-5.9
FIN-SWE difference		35.6*			26.1***			22.3**			

*** p < 0.001; ** p < 0.01; * p < 0.05

It is a reversal of the usual pattern that the Swedish speaking average score in mathematics is higher by 10 points in 2015 and had it not been for their performance, Finland's rank in mathematics could have been even lower than 13. The average score of Finnish speaking students in mathematics in 2003 (545) was the highest in the three PISA cycles compared. The Finnish speaking performance in mathematics fell steeply by 34 points between 2003 and 2015. The Swedish speaking average score also fell, from a high of 534 in 2003 to 520 (loss of 14 points, not significant) in 2015 but unlike the Finnish speaking students, the average score was stable between 2012 and 2015 (Table 12). The difference in average scores between Finnish speaking and Swedish speaking students was not significant in 2012 and 2015.

Table 12. *The performance of students in mathematics in Swedish and Finnish speaking schools over time.*

Mathematics	2003			2012			2015			Change 2003–2015	Change 2012–2015
	n	mean	s.e.	n	mean	s.e.	n	mean	s.e.		
Finnish-speaking	4589	544.9	2.0	7255	519.0	2.1	5534	510.5	2.4	–34.4***	–8.5
Swedish speaking	1207	534.3	2.3	1545	520.7	2.1	348	520.3	8.0	–14.0	–0.4
FIN-SWE difference		10.6***			–1.7			-9.8			

*** p < 0.001; ** p < 0.01; * p < 0.05

In the first assessment on collaborative problem solving in 2015, the Finnish speaking students scored 535, about 18 points higher than the Swedish speaking students. However, this difference was not statistically significant so it can be said that their performances were more or less equal (Table 13).

Table 13. *The performance of students in collaborative problem solving in Swedish and Finnish speaking schools 2015.*

Collaborative problem solving	2015		
	n	mean	s.e.
Finnish speaking	5534	535.0	2.7
Swedish speaking	348	516.9	9.1
FIN-SWE difference		18.1	

*** p < 0.001; ** p < 0.01; * p < 0.05

Suggestions for strategic action

Despite a trend of Finland's slipping performance, there are some positive elements that can be mentioned. For the first time since 2000, it is clear that Swedish students have outscored Finnish speaking students - in mathematics. They performed equally in collaborative problem solving. In 2015, the Finnish speaking students did better in science and Swedish speaking students did better in mathematics. Though mathematics is the weakest domain for Finland, reading is the weakest domain for Swedish speaking students. Both these domains are important for all other areas of learning and can be addressed in subject teaching but also in the multidisciplinary theme work. Finland cannot focus on improving only one domain at a time. Rather it is important to reinforce performance over all and to stabilize consistent performance at a high level in each of the domains.

High performers set the pace for excellence but not for classroom teaching

High performers set the standard for excellence by showing what is possible. Singapore had a higher percentage of students in levels 5 and 6 than Finland in all three domains. In particular, the percentage of high performers in Singapore in mathematics (35.8 per cent) is three times higher than in Finland (11.7).

In 2006 about a fifth of Finnish speaking students scored at levels 5 and 6 in science but in 2015 the percentage declined to 14.5 (Table 14). About a quarter of the students scored in levels 5 and 6 in Singapore. Among Swedish speaking students, 11.4 per cent of the students in both 2006 and 2015 scored at levels 5 and 6. Finnish speaking students had a significantly higher percentage in 2006 but not in 2015. So, the Finnish speaking students contributed to more to the decline of excellence in science as well as the lower difference between Finnish and Swedish speaking students.

Table 14. *Percentage of high performers in science in Finnish and Swedish speaking schools, 2006–2015.*

Science	2006			2015			Change 2006–2015
	n	%	s.e.	n	%	s.e.	
Finnish speaking	4413	21.4	0.8	5534	14.5	0.7	-6.9***
Swedish speaking	301	11.4	2.6	348	11.4	2.2	0.0
FIN-SWE difference		10.0***			3.1		

*** p < 0.001; ** p < 0.01; * p < 0.05

In the population of 15 year old Finnish speaking students at school, approximately 12 500 students would be high performers in 2006 but that number would have fallen in 2015 to 7 800. The estimated number of high performers in the population of 15 year old Swedish speaking students actually would have risen from 320 to 400.

In 2000 about a fifth of Finnish speaking students scored at levels 5 and 6 in reading, but in 2015, the percentage dropped to 14.1, a statistically significant difference (Table 15). About 15 per cent of the 15-year-olds scored in levels 5 and 6 in Singapore in 2015. Among Swedish speaking students, 9.5 per cent scored at levels 5 and 6 in 2000, which declined a little to 7.9 in 2015. Reading is the Achilles heel for Swedish speaking students. The difference between Finnish and Swedish speaking students was highest in 2000 (about 9 per cent) but though the differences declined, they were significant in 2009 and 2015 also.

Table 15. *Percentage of high performers in reading in Finnish and Swedish speaking schools, 2000–2015.*

Reading	2000			2009			2015			Change 2000–2015	Change 2009–2015
	n	%	s.e.	n	%	s.e.	n	%	s.e.		
Finnish-speaking	4622	18.9	0.9	4403	14.9	0.8	5534	14.1	0.8	-4.8***	-0.8
Swedish speaking	242	9.5	4.0	1407	8.3	0.9	348	7.9	2.3	-1.6	-0.4
FIN-SWE difference		9.4*			6.6***			6.2**			

*** p < 0.001; ** p < 0.01; * p < 0.05

Among the Finnish speaking population of 15 year olds, 11 300 students were estimated to be high performers in 2000 but the number dropped to 7 400 in 2015. The decline was very mild among the Swedish speaking population of 15 year olds, from about 300 in 2000 to 280 in 2015.

In 2003, over a fifth of Finnish speaking students scored at levels 5 and 6 in mathematics and the percentage fell to 15.3 in 2012 and further to 11.6 in 2015, about half of the percentage in 2003 (Table 16). About 36 per cent of the 15-year-olds scored in levels 5 and 6 in Singapore, triple the percentage of Finnish speaking students. Among Swedish speak-

ing students, 19.3 per cent scored at levels 5 and 6 in 2003 and the percentage dropped to 14.5 in 2012 and dropped further to 12.8 per cent in 2015. In 2015 a slightly higher percentage of Swedish speaking students than Finnish speaking students scored at level 5 and 6 though the difference was not significant.

Table 16. *Percentage of high performers in mathematics in Finnish and Swedish speaking schools, 2003–2015.*

Mathematics	2003			2012			2015			Change 2003–2015	Change 2012–2015
	n	%	s.e.	n	%	s.e.	n	%	s.e.		
Finnish-speaking	4 589	23.6	0.9	7 255	15.3	0.8	5 534	11.6	0.7	–12.0***	–3.7***
Swedish speaking	1 207	19.3	1.6	1 545	14.5	1.2	348	12.8	3.2	–6.5	–1.7
FIN-SWE difference		4.3*			0.8			–1.2			

*** p < 0.001; ** p < 0.01; * p < 0.05

At the population level, approximately 12 900 15-year-olds could be expected to score at levels 5 and 6 in 2003 but that number halved to 6 200 by 2015. The decrease in the number of Swedish speaking students was less, as 640 of them could be expected to score at levels 5 and 6 in 2003 and the number fell to 450 in 2015.

Suggestions for strategic action

Both Finnish speaking and Swedish speaking students did their best earlier in all three domains so it is clear that better performance can be achieved. It is remarkable that the Swedish speaking students equalled and even slightly overtook the Finnish speaking students in mathematics in 2015. This indicates that equal performance between the majority Finnish speaking and minority Swedish speaking students is certainly possible. However, it is important that that equality be achieved at a high level of performance. Singapore achieved its top position with a high proportion of students in the higher levels so if Finland is to share top honours, it must work to achieve a higher percentage of performers at levels 5 and 6 of both Finnish and Swedish speaking students. Such high performance in mathematics cannot be achieved in higher grades without a sound foundation in the lower grades.

Performance in the three domains in Swedish speaking urban and rural schools

In light of the concerns of school closures and the potential disadvantages of small rural schools, it is worthwhile to have a glimpse of Swedish speaking student performance by the location of their schools despite issues with the low number of cases. There were 11 Swedish speaking schools and only three of them were rural, two of which must have been small since only 5 students were sampled in each.

The average scores do not necessarily support the assumption that students in rural schools fare worse than urban schools. Some anomalies can be seen where one rural school with a sample of 5 students had averages in science and reading that were higher than Singapore's averages!

In science, none of the schools had an average score that was below the OECD average of 493 though there were two urban schools that had scores below 500. In reading, one urban and one rural school fell below the OECD average. The strength in mathematics is evident since none of the 11 schools had averages below the OECD average.

It is worth examining the disparities among the schools (Table 17). Even if the exceptional average score in science of 589 is omitted, 54 points separate the averages of the Swedish speaking students in the schools. This corresponds to well over a school year. Averages in three urban schools had averages over Finland's average score in science and four of urban schools had higher scores than the Swedish speaking average. In comparisons, the anomalous score of 555 was set aside. In reading, one urban and one rural school had averages below the OECD average of 493 and two fell on the average. Only the average in one urban school exceeded Finland's average and the averages of one rural and four urban schools exceeded the Swedish speaking average. A hundred score points separate the highest and lowest average score, which is well over 2 years of schooling. In mathematics, 50 points separate the highest and lowest school averages, which difference is equivalent to over one school year. Two rural schools and 6 urban schools had averages above Finland's performance and 2 rural schools and 2 urban schools had higher average scores than the Swedish speaking average (Figure 12). Four schools had average scores in all 3 domains below Finland's averages.

Table 17. *Performance in the four domains in Swedish speaking urban and rural schools. PISA 2015.*

School	Location	Number of students	Mean			
			Science	Reading	Math	Problem solving
1	Urban	38	519	499	506	529
2	Urban	39	499	480	513	482
3	Urban	40	553	525	542	531
4	Urban	40	512	493	513	511
5	Urban	38	497	493	499	500
6	Urban	27	525	516	519	523
7	Urban	39	537	530	553	537
8	Urban	39	550	520	534	533
9	Rural	5	589	555	549	581
10	Rural	37	503	512	501	500
11	Rural	5	510	430	534	516

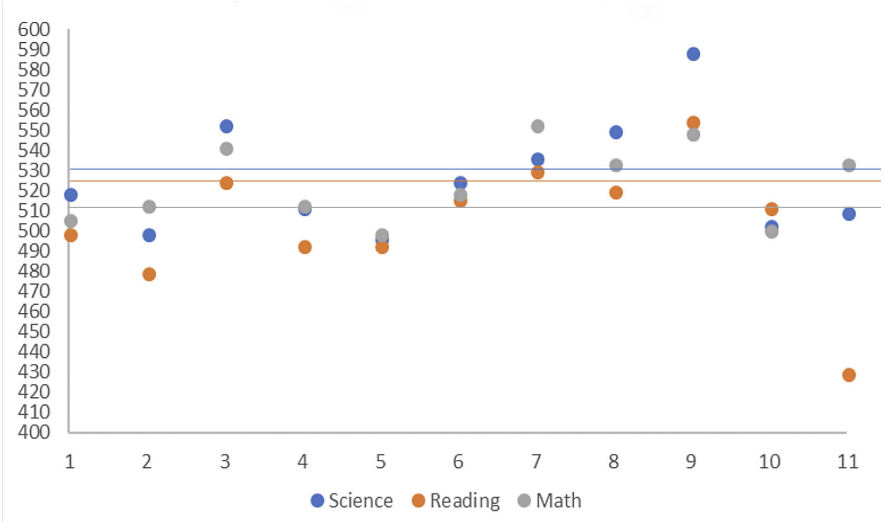


Figure 12. *Performance in the three domains in Swedish speaking schools compared to Finland's averages. PISA 2015.*

Suggestions for strategic action

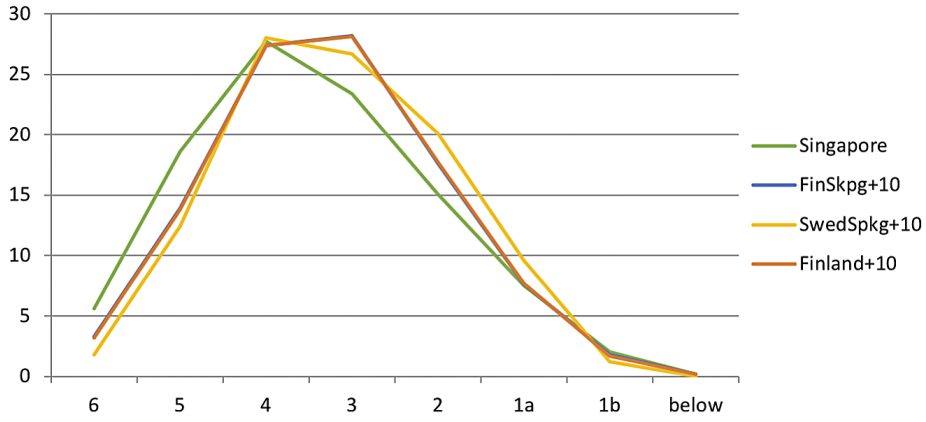
Reading is the domain that poses the greatest problems and mathematics the smallest in Swedish speaking schools. Within a school, the average scores of domains vary between 6 (admittedly, at a low level) and over 100. The elimination of such differences, by raising the averages of low performing schools will enable Swedish speaking students to perform at the superior level of the schools with high averages. The pairing of schools for mentor-

ing and sharing the teaching and learning strategies between Swedish speaking schools would be two useful strategies. The priority would be to work with the schools where averages are trailing by more than a school year. This would be a major contribution to equality regardless of location.

What would a gain of 10 score points for each student mean for national PISA performance?

As mentioned earlier it is easier to drop steeply than to gain rapidly. It would be difficult to match Singapore in three years when there is a large gap in the average score. A gain of 10 points in the score of each student over 3 years is something that teachers can set as an achievable goal. How would that affect the national performance? Would it impact the average performance and distribution of students in Finnish and Swedish speaking schools?

In science, the gain of 10 points for each student makes a difference for the Swedish speaking distribution which now had its peak in level 4. However, the Swedish speaking sample still had a smaller percentage of high performers and a larger proportion of low performers. The large sample of Finnish speaking students duplicated the distribution of Finland and the peak continued to be in level 3. Singapore had a higher percentage of high performers at levels 6 and 5. But Finnish and Swedish speaking samples had a reduced percentage in levels 1a and 1b – the very low performers – and gains in levels 3 and 4 (Figure 13).



Note: the Finnish speaking line was so similar to Finland that it is hidden by the line for Finland

Figure 13. *The impact of a gain of 10 points for each student in science for students in Finnish speaking, Swedish speaking and Finland's schools, compared to Singapore.*

Table 18. *Science score average and distribution with a gain of 10 points per student. PISA 2015.*

Science	Singapore	Finnish speaking + 10	Swedish speaking +10	Finland +10
Average	556	541	532	541
Range of 1st and 99th percentiles	458	437	401	435

Singapore still remained ahead but the difference has diminished. The Swedish speaking range was the tightest (indicating greater equality of outcome) and Singapore had the largest. (Table 18)

Finland's average score for reading dropped 10 points between 2000 and 2009 and a further 10 points in 2015. If the trend continued and Finland lost a further 10 points, it will lose its status as a high performing country in reading.

Again, the large sample of Finnish speaking students duplicated the distribution of Finland. The gain of 10 points for each student resulted in Finnish speaking peaking at level 4 at a higher percentage than for Singapore. Their distribution was similar to that of Singapore. But the Swedish speaking peak remained at level 3. Moreover, the Swedish speaking sample had a smaller percentage of high performers and a larger proportion at level 2. Singapore continued to have a higher percentage of high performers at level 6. Singapore and Finnish speaking had almost half of the students in levels 4, 5 and 6 (46%) but Swedish speaking students gained more, a percentage point more or 5 per cent, in those levels to reach 38 per cent (Figure 14). A gain of 10 points per student resulted in the Finnish speaking and Finnish average score in reading reaching the Singapore average. The Swedish average had a 19 point gap compared to the average of Singapore. The Swedish speaking range was the tightest (indicating greater equality of outcome) and Singapore had the largest (Table 19).

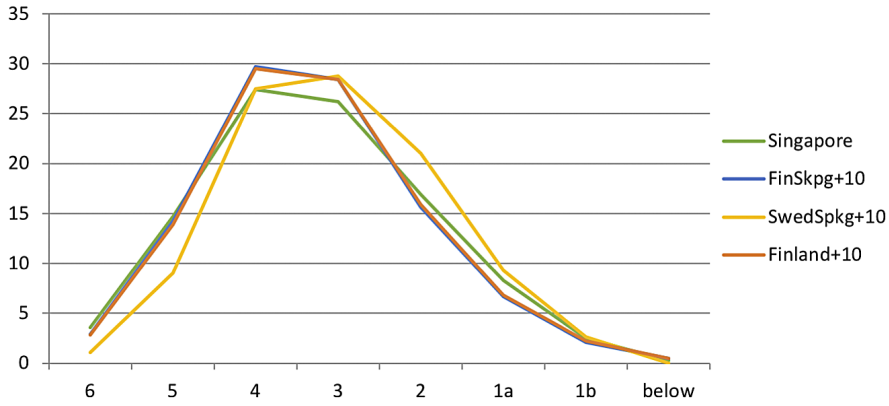


Figure 14. *The impact of a gain of 10 points for each student in reading for students in Finnish speaking, Swedish speaking and Finland's schools, compared to Singapore. PISA 2015.*

Note: the Finnish speaking line was so similar to Finland that it is hidden by the line for Finland.

Table 19. *Reading score average and distribution with a gain of 10 points per student. PISA 2015.*

Reading	Singapore	Finnish speaking + 10	Swedish speaking +10	Finland +10
Average	535	538	516	536
Range of 1st and 99th percentiles	441	436	413	435

In mathematics, Singapore had 60 per cent of high performers in levels 4, 5 and 6 and a mild peak at level 4. The large sample of Finnish speaking students duplicated the distribution of Finland. The gain of 10 points for each student resulted in Finland's peak at level 3 while the Swedish speaking peak was at level 4 with a higher percentage than Singapore. The Finnish speaking had a higher percentage than the Swedish speaking percentage in the lower levels. Singapore had 13 per cent at level 6, four times the percentage of Finland (Figure 15). A gain of 10 points per student would not reduce the gap with Singapore and the difference remained large, over 40 points (a school year) for Finland but about 30 points for the Swedish speaking students. The Swedish speaking range was the tightest (indicating greater equality of outcome) and Singapore had the largest. (Table 20)

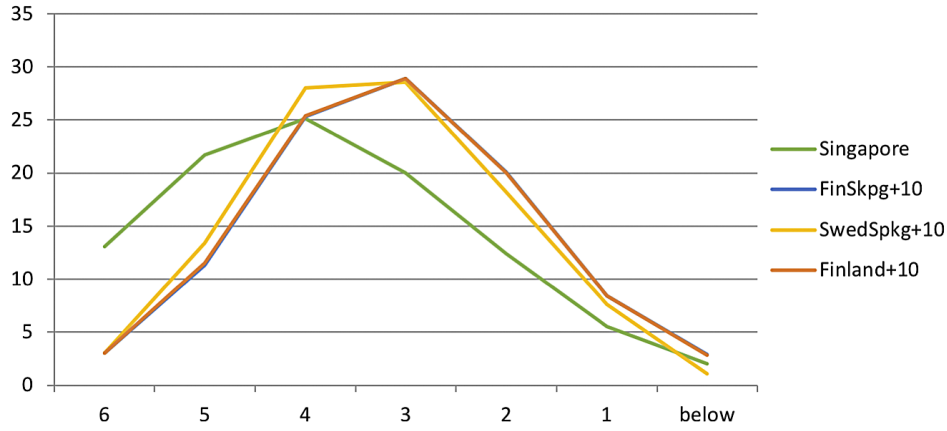


Figure 15. *The impact of a gain of 10 points for each student in mathematics for students in Finnish speaking, Swedish speaking and Finland's schools, compared to Singapore. PISA 2015.*

Note: the Finnish speaking line was so similar to Finland that it is hidden by the line for Finland

Table 20. *Mathematics score average and distribution with a gain of 10 points per student. PISA 2015.*

Mathematics	Singapore	Finnish speaking + 10	Swedish speaking +10	Finland +10
Average	564	520	530	521
range of 1st and 99th percentiles	441	436	413	435

Suggestions for strategic action

A gain of 10 points per student over three years is an achievable gain. However, this will require teachers to teach every child, rather than all children simultaneously all the time. In other words, individual and personalized instruction will be important. Except for mathematics, the gain of 10 points reduces the proportion of performers at the lowest levels. The gain of 10 points makes the distribution for reading similar to that of Singapore for Finland. But Singapore could improve its performance also during the next 3 years. It would be important to disrupt the trend of decline of 10 points in reading for each PISA cycle. It would be a worthwhile objective to have at least half of the sample in the top 3 levels, because reading is a foundation skill which is required for most other skills. The Finnish school system should make it a priority to improve their performance in mathematics and the Swedish school system should focus on advancing reading competencies.

Desirable and poor performances in all three domains among students in Finnish speaking and Swedish speaking schools

In terms of the achievement of equity, the news was positive. In Finland, 55.3 per cent of students scored above level 3 and above in science, reading and mathematics which is an indication of good all-round education. Fully 55.5 per cent of Finnish speaking students and 52.3 per cent of Swedish speaking students scored at level 3 and above in all three domains. The small difference was statistically insignificant.

Students who struggled with all three domains were liable to be a heavy draw on time, effort and resources to improve their scores. About a fifth of students in Finland scored at level 2 or below in all three domains. The percentage was 19.4 for Finnish speaking students and 21 for Swedish speaking students so there was not much difference between them. The estimated number of such Finnish speaking students in the population was 10 400 and among Swedish speaking students the respective number was 730. There were quite a high number of students at level 2. If only students at level 1 and below were considered, there would be about the same percentage of Finnish speaking students (6.3 per cent) and Swedish speaking students (6.4). The estimated number of very low Finnish speaking performers was 3 400 and very low Swedish speaking performers was 220.

Suggestions for strategic action

That about half of all students score at level 3 and above is evidence of the high quality education for which Finland is renowned. But it could be higher. However, in the future this proportion may be affected if the performance in one domain increases faster than the others, so efforts to have top ranking excellent performance must include work on all three domains concurrently.

In the case of students who are struggling in all three domains, which are the low performers at level 2 and below, it will be difficult to help their learning without additional resources particularly because a fifth of students fall into this category. For the very low performers at level 1 and below, it would be important to have some one-on-one teaching. A teacher and a teacher's aide may be a solution so that such students in a class can get individual attention. Careful monitoring in earlier years and corrective action will reduce the number before they get to the higher grades. It is unlikely that the number of students with difficulties in all three domains can be eliminated altogether but the aim should be to keep this number well below 10 per cent so that the both the teaching staff and the costs can be anticipated and managed.

Number and percentage of very low performers that need special attention

Very low performers could be considered to be those that score at level 1 or below level 1. These students are not being able to cope with their current studies and usually have a high rate of dropping out. They also have difficulties in future learning. In 2000, the first PISA report stated that Finland's first rank and high performance in all domains was due to the fact that there were few very low performers and even their average score was relatively high (Välijärvi et al. 2002).

It is important to know how many low performing students in the school system would need assistance, whether through more resources or through extra teaching. This is important for planning, budgeting and hiring commensurate with need. It is important that that the very low performers are provided with assistance early and that preventive measures are taken so that their numbers do not increase.

The percentage of very low performers in science in 2006 among Finnish speaking students was only 3.8 per cent, but the percentage shot up to 11.3 per cent in 2015 (Table 21). In 2006, 9.4 per cent of Swedish speaking students were very low performers, a proportion much greater than the Finnish speaking students. These very low performers increased in 2015 to 13.7 per cent, a rate that was similar to that of their Finnish counterparts.

In 2000, approximately 2 200 Finnish speaking very low performers would have required such assistance but the number ballooned to 6 000 in 2015. The estimated number of Swedish speaking very low performers increased from 260 to 480.

Table 21. *Very low performers in science in Finnish and Swedish speaking schools, PISA 2006 and 2015.*

Science	2006			2015			Change 2006–2015
	n	%	s.e.	n	%	s.e.	
Finnish speaking	4413	3.8	0.5	5534	11.3	0.7	7.5***
Swedish speaking	301	9.4	2.5	348	13.7	2.2	4.3
FIN-SWE difference		–5.6*			–2.4		

*** p < 0.001; ** p < 0.01; * p < 0.05

Reading has been an area of concern in Finland after the peak score in 2000. The percentage of very low performers in reading in 2000 among Finnish speaking students was 6.8 per cent. Furthermore, the percentage increased in 2009 to 7.8 per cent and in 2015 to 10.8 per cent – both statistically significant increases (Table 22). The percentages of Swedish speaking very low performers were similar to those for Science. In 2000, 10.7 per cent of Swedish speaking students were very low performers, and this increased in 2009 to 12.4 per cent and in 2015 to 15.1 per cent, increases that were statistically insignificant. The difference in the percentages between Finnish and Swedish speaking students was only statistically significant in 2009. This was essentially due to the oversampling of Swedish speaking schools in 2009, ensuring a sample large enough for powerful statistical comparisons.

In 2000, it was estimated that 4 100 Finnish speaking very low performers would have required such assistance but the number rose steeply to 5 800 in 2015. The number of Swedish speaking low performers increased from 340 to 530 in the same time period.

Table 22. *Very low performers in reading in Finnish and Swedish speaking schools, PISA 2000, 2009 and 2015.*

Reading	2000			2009			2015			Change 2000–2015	Change 2009–2015
	n	%	s.e.	n	%	s.e.	n	%	s.e.		
Finnish-speaking	4622	6.8	0.7	4403	7.8	0.8	5534	10.8	0.8	4.0***	3.0**
Swedish speaking	242	10.7	3.6	1407	12.4	0.9	348	15.1	2.8	4.4	2.7
FIN-SWE difference		-3.9			-4.6***			-4.3			

*** p < 0.001; ** p < 0.01; * p < 0.05

Finland's performance in mathematics has fallen sharply in recent cycles of PISA. The percentage of very low performers in mathematics in 2003 among Finnish speaking students was 6.7 per cent, similar to reading in 2000. Alarmingly, the percentage doubled in 2015 to 13.7 (Table 23). In 2000, 7.7 per cent of Swedish speaking students were very low performers, similar to the percentage for Finnish speaking students. It increased to 10.2 in 2012

and 11.5 in 2015, both percentages lower than for Finnish speaking students. The Swedish speaking percentage increases were insignificant.

In 2000, 3 700 Finnish speaking low performers would have required such assistance but the number rose dramatically to 7 300 in 2015. The number of Swedish speaking very low performers increased from 260 to 380 between 2000 and 2015.

Table 23. *Very low performers in mathematics in Finnish and Swedish speaking schools, PISA 2003, 2012 and 2015.*

Mathematics	2003			2012			2015			Change 2003–2015	Change 2012–2015
	n	%	s.e.	n	%	s.e.	n	%	s.e.		
Finnish speaking	4589	6.7	0.5	7255	12.2	0.7	5534	13.7	0.9	7.0***	1.5
Swedish speaking	1 207	7.7	0.8	1545	10.2	0.9	348	11.5	2.6	3.8	1.3
FIN-SWE difference		-1.0			2.0			2.2			

*** p < 0.001; ** p < 0.01; * p < 0.05

The percentage of low performers in collaborative problem solving was about a fifth of all students. The percentage in 2015 among Finnish speaking students was 17.9 per cent (Table 24). In 2015, 21.2 per cent of Swedish speaking students were low performers, similar to the percentage for Finnish speaking students.

Table 24. *Very low performers in problem solving in Finnish and Swedish speaking schools, PISA 2015.*

Collaborative problem solving	2015		
	n	%	s.e.
Finnish speaking	5534	17.9	1.0
Swedish speaking	348	21.2	3.3
FIN-SWE difference		-3.3	

*** p < 0.001; ** p < 0.01; * p < 0.05

Suggestions for strategic action

When a fifth of students in the classroom are low performers, as it was in the case collaborative problem solving it is a challenge for teachers because it implies that students are not able to recall, evaluate, choose and apply their knowledge and skills to solve the problem. The use of every day issues that are meaningful for students will help them to practice and later discuss their solutions.

Subject matter teachers also face a challenge because of the increasing percentage of students who are very low performers. It would be important for teachers to evaluate the

level of understanding of their subject among their students so that additional help can be provided to those who are very low performers from the start to try to help them catch up. There is just over a tenth of students who have difficulties in each subject. Teachers would need to repeat key concepts periodically to ensure their comprehension by students. It would be useful for teachers in the three domains to meet and discuss student issues frequently to prevent students having difficulty in all three domains and also to share successful strategies that have worked with individual students.

Reducing risk through monitoring the students who are at level 2 and below

Students in level 2 are at the cusp, and they can either improve and perform at higher level or fall to the substandard level 1. Though not all these students may need the special attention of low performing students, it would be useful to monitor the progress of all the students at level 2 and below.

In general, the lowest third were low performers in each domain and the lowest quarter of students had difficulty in two domains among students in Finnish and Swedish speaking schools (Table 25).

Table 25. *Students who scored at level 2 and below in each domain and combinations of domains in Finnish speaking and Swedish speaking schools and in Finland in total. PISA 2015.*

	Percentage of students at level 2 and below					
	Science	**Reading**	**Mathematics**	**Science and Reading**	**Science and Mathematics**	**Reading and Mathematics**
Finnish speaking	30.3	28.2	35.7	22.0	24.8	22.0
Swedish speaking	34.0	36.8	30.6	27.4	23.2	23.9
Finland	30.5	28.7	35.6	22.0	24.6	22.3

Suggestions for strategic action

Monitoring reduces risk of deterioration, increases prevention and improves early intervention. Therefore, subject teachers should monitor the lowest third of children to see if any of them are finding it increasingly difficult to keep up as these students progress through grades. They should note that a quarter of these children are likely to have difficulties in more than one domain. This will ensure that the number of children who need additional or special help are maintained at a manageable number.

Performance of Finnish and Swedish speaking boys and girls in science, reading and mathematics

It can be said that Finland's top rank in reading in 2000 was achieved despite the large gender gap in their average scores. For instance, low performing boys in reading still achieved higher than the OECD average. This difference is compounded by the difference between the performance of Finnish and Swedish speaking 15 year olds though the Swedish population is too small to make a huge difference in Finland's average score. Fifteen years later, despite efforts, this gender gap stubbornly persists in reading. So, it is important to analyse the gender performance to determine what further strategic action can be taken.

Finnish speaking girls had the highest average score (567) in science in 2006 and Finnish speaking boys had almost the same average score (563) displaying very little gender difference (Table 26). Swedish speaking girls had a lower average score (526) compared to Swedish speaking boys whose average score was 536 so there was a difference of 10 points. Finnish speaking girls lost around 25 points in 2015 when their average score was 541. The average score of Swedish speaking girls rose by 8 points to 534. The average scores of Finnish and Swedish speaking boys fell in 2015 when the former scored 522 and the latter 513. The difference between Finnish speaking girls and boys in 2006 was only 4 points but it grew to 19 in 2015 (Table 27). In the case of gender difference of Swedish speaking students, it was -10 points (boys scored higher) but it grew by 30 points to 21 points in 2015. Thus, both the Finnish and Swedish speaking boys trailed the girls by about half a school year.

Table 26. *Performance of boys and girls in science in Finnish and Swedish speaking schools, 2006 and 2015.*

Science	**2006**			**2015**			**Change 2006–2015**
Girls	n	mean	s.e.	n	mean	s.e.	
Finnish speaking	2236	566.7	2.5	2694	540.9	2.7	-25.8***
Swedish speaking	149	525.7	9.2	169	533.7	9.7	8.0
FIN-SWE difference		41.0***			7.2		
Boys	n	mean	s.e.	n	mean	s.e.	
Finnish speaking	2177	563.0	2.7	2840	522.1	3.0	-40.9***
Swedish speaking	152	535.6	7.0	179	512.6	8.4	-23.0
FIN-SWE difference		27.4***			9.5		

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 27. *Mean difference between girls and boys in science, 2006 and 2015.*

Science	2006	2015
Girl-boy difference		
Finnish speaking	3.7	18.9***
Swedish speaking	-9.9	21.0*

*** p < 0.001; ** p < 0.01; * p < 0.05

Finnish speaking girls had the highest average score (574) in reading in 2000, a score that was higher than that of first ranking Singapore in 2015. Swedish speaking girls had an average score (533) that was 40 points lower (Table 28). Finnish boys had an average score (522) that was 52 points lower. Swedish boys had an average score (486) that was lower than the OECD average and 87 points lower than Finnish girls. So Finnish boys lagged about one school year behind, while Swedish boys were two school years behind Finnish girls. The average score of Finnish girls fell 22 points in 2015 to 552, which was still higher than the average score of Singapore. The average score of Swedish girls remained the same at 530 in 2015. The average score of Finnish boys lost 15 points to 505 but the Swedish boys remained at the same low score at 484. So, the lower reading score of Finland is due to the decline in scores of Finnish speaking boys and girls. The difference between Finnish speaking girls and boys was 52 points in 2000 and the difference between Swedish speaking girls and boys was 47 points which would be equivalent to one school year in each case (Table 29). The difference between Finnish speaking boys and girls fell to 47 points in 2015 because both their average scores fell but the average of girls declined more. Because of the stable performance of Swedish speaking boys and girls, the difference between them was 46 points, similar to 2000. In both cases, the difference amounted to one school year. Swedish speaking boys scored below the OECD average in all three years.

Table 28. *Performance of boys and girls in reading in Finnish and Swedish speaking schools, 2000, 2009 and 2015.*

Reading	2000			2009			2015			Change 2000–2015	Change 2009–2015
Girls	n	mean	s.e.	n	mean	s.e.	n	mean	s.e.		
Finnish speaking	2371	573.6	2.9	2215	565.2	2.5	2694	551.8	2.9	-21.8**	-13.4**
Swedish speaking	136	533.1	11.1	739	538.2	3.0	169	530.2	8.1	-2.9	-8.0
FIN-SWE difference		40.5***			27.0***			21.6*			
Boys	n	mean	s.e.	n	mean	s.e.	n	mean	s.e.		
Finnish speaking	2251	521.7	3.1	2188	510.0	2.8	2840	505.3	3.3	-16.4*	-4.7
Swedish speaking	106	486.4	18.9	668	483.9	3.9	179	484.4	10.6	-2.0	0.5
FIN-SWE difference		35.3			26.1***			20.9			

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 29. *Mean difference between girls and boys in reading, 2000, 2009 and 2015.*

Reading Girl-boy difference	2000	2009	2015
Finnish speaking	51.9***	55.2***	46.5***
Swedish speaking	46.7***	54.3*	45.8***

*** p < 0.001; ** p < 0.01; * p < 0.05

In 2003, the average score of Finnish speaking boys in mathematics was 549, higher than Finnish girls who scored 541 (Table 30). Swedish speaking boys scored 539 on average while Swedish speaking girls scored an average of 531. Unfortunately, by 2015, the average score of Finnish boys dropped by 42 points (a school year) to 507. The average score of Finnish speaking girls also slipped by 27 points (half a school year) to 514. In 2015, the average score of Swedish boys had dropped about 20 points to 518 but this difference was not statistically significant. Swedish girls lost only 8 points and their average score was 523. It is interesting that the difference in average mathematics score between Finnish girls and boys flipped from -7 to 8 points as Finnish girls did better in mathematics in 2015 (Table 31). The difference in the average score between Swedish boys and girls was not significant in 2015.

Table 30. *Performance of boys and girls in mathematics in Finnish and Swedish speaking schools, 2003, 2012 and 2015.*

Mathematics	2003			2012			2015			Change 2003–2015	Change 2012–2015
Girls	n	mean	s.e.	n	mean	s.e.	n	mean	s.e.		
Finnish speaking	2296	541.2	2.3	3608	520.4	2.3	2694	514.5	2.6	-21.8**	-13.4**
Swedish speaking	633	530.5	3.3	757	520.5	3.0	169	522.7	9.3	-2.9	-8.0
FIN-SWE difference		10.7**			-0.1			-8.2			
Boys	n	mean	s.e.	n	mean	s.e.	n	mean	s.e.		
Finnish speaking	2293	548.5	2.6	3647	517.7	2.8	2840	506.7	2.8	-16.4*	-4.7
Swedish speaking	574	538.5	3.7	788	520.9	3.1	179	518.1	8.7	-2.0	0.5
FIN-SWE difference		10.0*			-3.2			-11.4			

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 31. *Mean difference between girls and boys in mathematics, 2003, 2012 and 2015.*

Mathematics Girl-boy difference	2003	2012	2015
Finnish speaking	-7.3**	2.7	7.8**
Swedish speaking	-8.0	-0.4	4.6

*** p < 0.001; ** p < 0.01; * p < 0.05

Suggestions for strategic action

As pointed out earlier, gender and minority/majority differences were two factors where equality has been difficult to achieve and maintain in Finland. The high point was in 2006, in science, among Finnish speaking boys and girls: so schools and teachers know that it is possible. But by 2015, the difference between girls and boys was about half a school year for both Finnish and Swedish speaking students.

Equality between genders in reading should be made a priority because it affects learning through the entire compulsory education system and Finland has not made much progress over the last 15 years. A difference of one school year has persisted in 2000, 2009 and 2015. Eliminating a difference between boys and girls of one school year in reading will take a lot of effort and time for both Finnish and Swedish speaking schools but it cannot be avoided. Reading is a key foundational skill which is required for the successful future of these students.

In mathematics, the difference in performance is not so stark but it has been inconsistent. It has been compounded by the fact that the average scores for Finnish and Swedish speaking boys and girls have declined from 2003 to 2015 at different rates. So, the scores of top scoring Finnish speaking boys declined more than for Finnish speaking girls and in 2015 girls had a higher score than boys. The difference in average scores for Swedish speaking boys and girls was not large or statistically significant.

The average scores of Finnish and Swedish speaking boys and girls in mathematics shows the difficulties that Finland has had in balancing excellence and equity (Figure 16). In 2003, Finland had excellent results and relatively good equity. In 2012, excellence in mathematics had fallen but it had achieved perfect gender and majority/minority equality but at a lower level of performance. Both excellence and equity had worsened in 2015. In the ideal situation, both excellence and equity should be high, at least at levels that have been previously achieved by Finland.

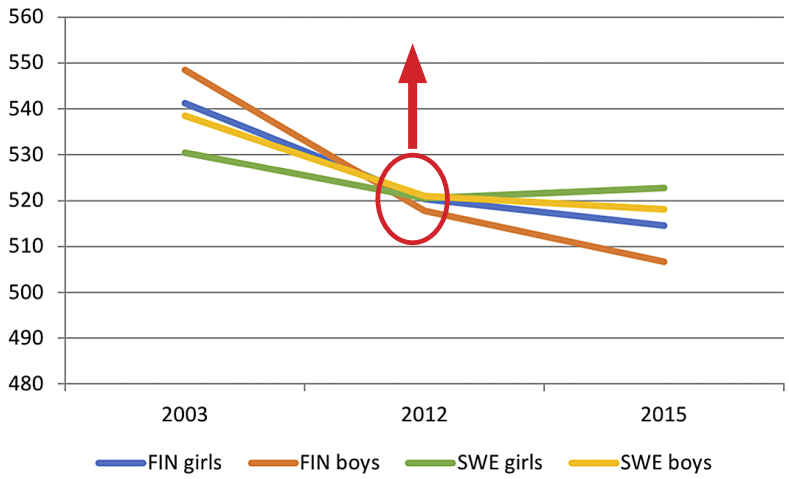


Figure 16. *Gender differences in mathematics over time 2003–2015.*

Teachers can plan strategies for effective teaching for high and low performing boys and girls

Teachers need to have a repertoire of teaching methods, but they tend to design and plan their instruction based on their own experience. Student performance data will help them to have teaching components that target students of both genders of different abilities better.

In PISA 2006, double the percentage of Finnish speaking girls scored at levels 5 and 6 in science compared to Swedish speaking girls (Table 32). In 2015, 16 per cent of Finnish speaking girls were high performers and the difference with Swedish girls had dwindled

to about 5 per cent. The pattern was similar for boys, however, the percentage of Finnish speaking boys dropped even more, so the difference with Swedish speaking boys was only a couple of percentage points. The difference between Finnish speaking girls and boys was greater than for Swedish speaking girls and boys.

But the key issue is to know how many high performers in science there would be in a cohort or a class room. In 2006, there were some 6 100 high performing Finnish speaking girls and 6 400 high performing Finnish speaking boys in the 15 year old population in Finland (Table 34). However, the number of high performing Finnish speaking boys fell to 3 700 in 2015. The number of high performing Finnish speaking girls decreased to less than 4 100. There were 150 high performing Swedish speaking girls and 170 high performing boys in science in 2006. In 2015, the number of high performing Swedish speaking girls had risen to 180 and to 220 high performing Swedish speaking boys. Though high performing students may not be equally distributed among schools, teachers in Finnish and Swedish speaking teachers can estimate that up to 15 per cent of their students could be high performers in science in 2015. More Finnish speaking girls (53%) were likely to be high performers than boys but more Swedish speaking boys (57%) were likely to be high performers than girls.

Table 32. *Percentage of high performing boys and girls (levels 5 and 6) in science in Finnish and Swedish speaking schools in 2006 and 2015.*

Science	**2006**			**2015**			**Change 2006–2015**
Girls	n	%	s.e.	n	%	s.e.	
Finnish speaking	2 236	20.6	1.1	2 694	15.8	1.0	-4.8***
Swedish speaking	149	11.1	3.7	169	11.2	3.1	0.1
FIN-SWE difference		9.5*			4.6		
Boys	n	%	s.e.	n	%	s.e.	
Finnish speaking	2 177	22.1	1.1	2 840	13.3	0.8	-8.8***
Swedish speaking	152	11.8	3.4	179	11.5	2.7	-0.3
FIN-SWE difference		10.3**			1.8		

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 33. *Difference between high performing girls and boys in science in Finnish speaking and Swedish speaking schools in 2006 and 2015.*

Science / **Girl-boy difference**	**2006**	**2015**
Finnish speaking	-1.5	2.5*
Swedish speaking	-0.7	-0.3

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 34. *Estimated number of high performers in science in the population, 2006 and 2015.*

Girls	**2006**	**2015**	**% of girls among high performers 2015**
Finnish speaking	6 100	4 100	52.7
Swedish speaking	150	180	45.4
Boys	**2006**	**2015**	**% of boys among high performers 2015**
Finnish speaking	6 400	3 700	47.3
Swedish speaking	170	220	54.6

Over a quarter of the Finnish speaking girls scored at levels 5 and 6 in reading in 2000 but that percentage dropped to 19 per cent in 2015. In contrast, around 10 per cent of Swedish speaking girls were high performers in 2000, 2009 and 2015 (Table 35). The percentage of Finnish speaking boys also fell slightly from 11 to 9 between 2000 and 2015. Much fewer Swedish speaking boys were high performers and their percentage hovered around 5 per cent in 2000, 2009 and 2015.

There were roughly 8 000 Finnish speaking girls who were high performers in reading in 2000 but that number tumbled to about 5 000 in the 15 year old population in 2015 (Table 37). There were much lower numbers of boys that were high performers in reading. There were 3 300 Finnish speaking high performing boys in 2000 but their numbers sank to 2 600 in 2015. There were 160 high performing Swedish speaking girls and 110 boys in reading. Teachers in Finnish speaking schools can estimate that between 10 and 20 per cent of students would be high performers while teachers in Swedish speaking schools can guess that up to 10 per cent would be high performers. More or less two thirds of all high performers in reading are girls.

Table 35. *Percentage of high performing boys and girls (levels 5 and 6) in reading in Finnish speaking and Swedish speaking schools in 2000, 2009 and 2015.*

Reading	**2000**			**2009**			**2015**			**Change 2000–2015**	**Change 2009–2015**
Girls	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**		
Finnish speaking	2 371	26.4	1.4	2 215	21.5	1.2	2 694	19.1	1.1	-7.3***	-2.4
Swedish speaking	136	11.2	4.6	739	12.3	0.9	169	10.1	3.1	-1.1	-2.2
FIN-SWE difference		15.2**			9.2***			9.0**			
Boys	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**		
Finnish speaking	2 251	11.2	0.9	2 188	8.4	0.9	2 840	9.4	0.8	-1.8	1.0
Swedish speaking	106	7.2	4.2	668	4.2	0.9	179	5.9	2.7	-1.3	1.7
FIN-SWE difference		4.0			4.2***			3.5			

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 36. *Difference between high performing girls and boys in reading in Finnish speaking and Swedish speaking schools in 2000, 2009 and 2015.*

Reading Girl-boy difference	2000	2009	2015
Finnish speaking	15.2***	13.1***	9.7***
Swedish speaking	4.0	8.1***	4.2

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 37. *Estimated number of high performers in reading in the population, 2000, 2009 and 2015.*

Girls	2000	2009	2015	% of girls among high performers 2015
Finnish speaking	8 100	6 200	4 900	65.6
Swedish speaking	200	240	160	59.4
Boys	**2000**	**2009**	**2015**	**% of boys among high performers 2015**
Finnish speaking	3 300	2 400	2 600	34.4
Swedish speaking	100	80	110	40.6

Mathematics is Finland's weakest domain. While about a fifth of Finnish speaking girls were high performers in mathematics in 2003, that proportion toppled by half to 11 per cent by 2015 (Table 38). About 17 per cent of Swedish speaking girls were high performers in 2003; that percentage also fell to 11. Above a quarter of the Finnish speaking boys were high performers in 2003 but the percentage plummeted to 12 in 2015. About 22 per cent of Swedish speaking boys scored in levels 5 and 6 in mathematics and that percentage also dropped to 14 per cent in 2015. A higher percentage of Swedish boys were high performers than Swedish speaking girls or Finnish speaking boys or girls.

Finnish speaking teachers can estimate that roughly 10 per cent of students would be high performers while Swedish speaking teachers can also guess that roughly 10 per cent would be high performers. Roughly half of all high performers are boys.

Table 38. *Percentage of high performing girls and boys (levels 5 and 6) in mathematics in Finnish speaking and Swedish speaking schools in 2003, 2012 and 2015.*

Mathematics	2003			2012			2015			Change 2003–2015	Change 2012–2015
Girls	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**		
Finnish speaking	2296	21.1	1.0	3608	14.2	1.0	2694	11.2	0.9	-9.9***	-3.0*
Swedish speaking	633	17.1	2.1	757	13.0	1.6	169	11.3	4.0	-5.8	-1.7
FIN-SWE difference		4.0			1.2			-0.1			
Boys	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**		
Finnish speaking	2293	26.2	1.3	3647	16.4	1.0	2840	12.0	0.8	-14.2***	-4.4***
Swedish speaking	574	21.8	2.3	788	15.8	1.7	179	14.2	3.4	-7.6	-1.6
FIN-SWE difference		4.4			0.6			-2.2			

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 39. *Difference between high performing girls and boys in mathematics in Finnish speaking and Swedish speaking schools in 2003, 2012 and 2015.*

Mathematics Girl-boy difference	2003	2012	2015
Finnish speaking	-5.1***	-2.2	-0.8
Swedish speaking	-4.7	-2.8	-2.9

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 40. *Estimated number of high performers in mathematics in the population, 2003, 2012 and 2015.*

Girls	2003	2012	2015	% of girls among high performers 2015
Finnish speaking	5800	3900	2900	46.7
Swedish speaking	300	240	180	40.5
Boys	**2003**	**2012**	**2015**	**% of boys among high performers 2015**
Finnish speaking	7200	4700	3300	53.3
Swedish speaking	340	300	270	59.5

Only 3 per cent of Finnish girls scored under level 2 but three times as many or 11 per cent of Swedish speaking girls were low performers in science in 2006 (Table 41). By 2015, the per cent of Finnish girls had increased to 8 but Swedish speaking girls remained at about the same percentage. In 2009, 5 per cent of Finnish boys were low performers but the percentage grew to 14 by 2015. The percentage of Swedish boys was 8 in 2006 but it doubled to 17 by 2015.

Within the Finnish speaking 15 year old population of girls in 2006, only some 900 were low performers in science with scores below level 2 but that number had grown to 2 100 by 2015 (Table 43). In 2006, there were 150 low performing Swedish speaking girls and the number increased to 160 in the population in 2015. The increase was greater among Swedish speaking boys as the 110 of low performers in 2006 had increased to 320. Up to 15 per cent of students in both Finnish and Swedish speaking schools are low performers. Two thirds of all low performers in science are boys.

Table 41. *Percentage of low performing girls and boys (below level 2) in science in Finnish speaking and Swedish speaking schools in 2006 and 2015.*

Science	**2006**			**2015**			**Change 2006–2015**
Girls	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**	
Finnish speaking	2 236	2.9	0.5	2 694	8.1	0.8	5.2***
Swedish speaking	149	10.9	4.1	169	10.1	2.6	-0.8
FIN-SWE difference		-8.0			-2.0		
Boys	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**	
Finnish speaking	2 177	4.8	0.6	2 840	14.3	1.0	9.5***
Swedish speaking	152	8.0	3.0	179	16.8	4.0	8.8
FIN-SWE difference		-3.2			-2.5		

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 42. *Difference between low performing girls and boys in science in Finnish speaking and Swedish speaking schools in 2006 and 2015.*

Science / **Girl-boy difference**	**2006**	**2015**
Finnish speaking	-1.9**	-6.2***
Swedish speaking	2.9	-6.7

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 43. *Estimated number of low performers in science in the population, 2006 and 2015.*

Girls	**2006**	**2015**	**% of girls among low performers 2015**
Finnish speaking	900	2 100	34.7
Swedish speaking	150	160	34.0
Boys	**2006**	**2015**	**% of boys among low performers 2015**
Finnish speaking	1 400	3 900	65.3
Swedish speaking	110	320	66.0

Generally, girls performed better in reading than boys and 75 per cent of low performers were boys (Tables 44–46). In 2000, there were just 3 per cent of Finnish speaking girls that

were low performers in reading and by 2015, it had increased to 6 per cent. The increase was smaller for Swedish girls because their percentage rose from some 5 in 2000 to 6 per cent in 2015. Among Finnish speaking boys, 10.6 per cent were low performers in reading in 2000 and it increased to 15.7 per cent in 2015. Swedish speaking boys had the most difficulty with reading. About 18.4 per cent of Swedish speaking boys were low performers in 2000 and the number grew to 21.4 per cent by 2015. In the population of 15 year old Finnish speaking girls 950 were low performers and in 2015, the number had grown to 1 450. In the Swedish speaking population of 15 year old girls there were only 85 low performers and but by 2015, 120 were low performers. There were 3 100 low performing Finnish speaking boys in the population of their peers in 2000 which increased to 4 300 in 2015. Though there were only 250 low performing boys in the 15 year old Swedish speaking population of boys in 2000, the number had almost doubled to 400 in 2015.

Table 44. *Percentage of low performing girls and boys (below level 2) in reading in Finnish speaking and Swedish speaking schools in 2000, 2009 and 2015.*

Reading	**2000**			**2009**			**2015**			**Change 2000–2015**	**Change 2009–2015**
Girls	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**		
Finnish speaking	2 371	3.1	0.7	2 215	3.0	0.5	2 694	5.6	0.7	2.5*	2.6**
Swedish speaking	136	4.8	1.4	739	5.4	1.0	169	7.7	2.5	2.9	2.3
FIN-SWE difference		-1.7			-2.4*			-2.1			
Boys	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**		
Finnish speaking	2 251	10.6	0.9	2 188	12.6	0.9	2 840	15.7	1.2	5.1***	3.1*
Swedish speaking	106	18.4	8.5	668	19.6	1.9	179	21.4	4.6	3.0	1.8
FIN-SWE difference		-7.8			-7.0***			-5.7			

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 45. *Difference between low performing girls and boys in reading in Finnish speaking and Swedish speaking schools in 2000, 2009 and 2015.*

Reading / **Girl-boy difference**	**2000**	**2009**	**2015**
Finnish speaking	-7.5***	-9.6***	-10.1***
Swedish speaking	-13.6**	-14.2***	-13.7**

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 46. *Estimated number of low performers in reading in the population, 2000, 2009 and 2015.*

Girls	**2000**	**2009**	**2015**	**% of girls among low performers 2015**
Finnish speaking	950	870	1 450	25.1
Swedish speaking	85	110	120	23.5
Boys	**2000**	**2009**	**2015**	**% of boys among low performers 2015**
Finnish speaking	3 100	36 00	4 300	74.9
Swedish speaking	250	370	400	76.5

More than one in ten students are low performers in mathematics in 2015. In 2003, 6 per cent of Finnish speaking girls were low performers in mathematics with scores below level 2 and this percentage almost doubled to 11 in 2015 (Table 47). Almost 8 per cent of Swedish speaking girls were low performers in 2003 but the percentage grew slightly to about 10 per cent in 2015. Roughly two thirds of low performers were boys. Among Finnish speaking boys, 7 per cent were low performers in mathematics in 2003 and that percentage grew to 16 by 2015. Swedish speaking boys had approximately the same proportion, 7.5 per cent of low performers in 2006 and their percentage in 2015 was 13. About 1 700 Finnish speaking 15 year old girls were low performers in mathematics in 2003 and that number almost doubled in 2015 to 2 900. The number of Swedish speaking girls who were low performers in mathematics in their peer population was 140 and it only rose 160 in 2015. Within the 15 year old population of Finnish speaking boys, approximately 2 000 of them were low performers in mathematics and this number rose to 4 400 by 2015. There were 120 boys in the 15 year old population of Swedish speaking boys who were low performers in 2006 and the number doubled in 2015 to 240 (Table 49).

Table 47. *Percentage of low performing girls and boys (below level 2) in mathematics in Finnish speaking and Swedish speaking schools in 2003, 2012 and 2015.*

Mathematics	**2003**			**2012**			**2015**			**Change 2003–2015**	**Change 2012–2015**
Girls	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**		
Finnish speaking	2 296	6.1	0.6	3 608	10.4	0.8	2 694	11.3	0.9	5.2***	0.9
Swedish speaking	633	7.9	1.2	757	8.3	1.2	169	9.9	3.4	2.0	1.6
FIN-SWE difference		-1.8			2.1			1.4			
Boys	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**	**n**	**%**	**s.e.**		
Finnish speaking	2 293	7.3	0.8	3 647	14.0	0.9	2 840	15.9	1.1	8.6***	1.9
Swedish speaking	574	7.5	1.3	788	12.0	1.4	179	12.9	3.7	5.4	0.9
FIN-SWE difference		-0.2			2.0			3.0			

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 48. *Difference between low performing girls and boys in mathematics in Finnish speaking and Swedish speaking schools in 2003, 2012 and 2015.*

Mathematics Girl-boy difference	2003	2012	2015
Finnish speaking	-1.2	-3.6***	-4.6***
Swedish speaking	0.4	-3.7*	-3.0

*** p < 0.001; ** p < 0.01; * p < 0.05

Table 49. *Estimated number of low performers in mathematics in the population, 2003, 2012, and 2015.*

Girls	**2003**	**2012**	**2015**	**% of girls among low performers 2015**
Finnish speaking	1 700	2 800	2 900	40.0
Swedish speaking	140	150	160	39.6
Boys	**2003**	**2012**	**2015**	**% of boys among low performers 2015**
Finnish speaking	2 000	4 000	4 400	60.0
Swedish speaking	120	230	240	60.4

For annual planning, budgeting and resourcing, it is useful to know how many students were high performers and how many are low performers in each of the three subjects. It is also useful information for subject matter teachers.

Table 50. *Total number of high and low performers in science, reading and mathematics in Finnish and Swedish schools. PISA 2015.*

Total Finnish speaking 15 year old population 2015							53 455	
Total Swedish speaking 15 year old population 2015							3 479	
Estimated number in the population								
	Science		**Reading**		**Mathematics**		**All 3 domains**	
Finnish	**Below level 2**	**levels 5 and 6**	**Below Level 2**	**Levels 5 and 6**	**Below level 2**	**Levels 5 and 6**	**Below level 2**	**Levels 5 and 6**
n	6 094	7 751	5 773	7 537	7 430	6 201	3 368	3 261
%	11.4	14.5	10.8	14.1	13.9	11.6	6.3	6.1
Swedish	**Below level 2**	**levels 5 and 6**	**Below Level 2**	**Levels 5 and 6**	**Below level 2**	**Levels 5 and 6**	**Below level 2**	**Levels 5 and 6**
n	480	397	522	275	411	445	223	150
%	13.8	11.4	15.0	7.9	11.8	12.8	6.4	4.3

In total, there were around 6 000 Finnish speaking students who were low performers in science and reading and 7 000 in mathematics, ranging from 12 to 15 per cent. Half of the number of Finnish speaking low performers in science, reading or mathematics are low performers in all three domains.

There were about 500 Swedish speaking students who were low performers in science and reading and 400 in mathematics, ranging from 13 to 15 per cent. About 220 Swedish speaking students or 6.4 per cent of the Swedish speaking 15-year-old students' population were low performers in all three domains.

Suggestions for strategic action

There is much discussion about the need to have more people in the STEM (Science, Technology, Engineering, Mathematics) professions which means students need to perform well in the three domains during their time in compulsory school. The goal of compulsory education would be to ensure that all students have a good foundation in all three domains whether they intend to pursue such a career in STEM or not. Teachers need to have a range of teaching strategies, resources and tools to handle students who are high and low performers in a class in addition to the average students who range between them.

Teachers must provide challenge to high performing students while encouraging and helping low performing students. This will be particularly important in reading and mathematics. Flipped class room techniques can work with high performing students who can engage in complex learning activities at home and report on them in school but low performers will need step by step guidance as well reiteration for deep learning. High performing students can be group leaders and peer mentors. It may be necessary to recap concepts and skills frequently to ensure that the low performers are able to keep up with new material, particularly in mathematics. Individualization will be important so that every student can learn from one or more of the strategies that the teacher will use in the classroom.

There can be annual differences in the cohort of 15 year olds, however, the trends are clear. In all the three domains, the number of students who are low performers is increasing. As a nation, Finland needs to set some priorities to progressively plan to improve the performance of students and to halt the decline. Since the numbers are known, budgets can assign additional funding per student to ensure that all regions and municipalities are able to implement such improvement plans which could start with students who have difficulties with all three subjects. If some of these students are foreign language speakers, special programs to assist them will be required in addition.

This proportion of very low performers (levels 1b, 1a and below 1) requires national agency attention in terms of resources and additional teachers, particularly for mathematics in both Finnish and Swedish speaking systems. A teacher may have one or two students in each class, but such students will need a lot of hours of additional individual teaching. National agency attention should also note that half of very low performers have difficulty in all three domains which requires more collaborative teaching and special teaching materials. Teacher training institutions need to be encouraged to teach new teachers how to implement the best pedagogy for classrooms with diverse abilities.

Teaching reading to address the types of reading skills that are difficult for low performing students

The types of questions that Swedish speaking students who scored at level 2 and below in reading were examined because if teachers know the type of skills that are difficult, they could bolster the teaching of these skills. Eighty seven questions in reading were examined and the questions that over 70 per cent of students at level 2 and below got wrong were scrutinized. There were 33 questions with which they had difficulties. Of course, it is expected that these questions require higher order reading skills but it could also be because they are slow readers or they only partially understood the questions. (Table 51)

More students had greater difficulties with open constructed questions where they had to reason to find an answer compared to multiple choice questions which presented a choice of answers. Continuous text questions were missed twice as often compared to non-continuous questions. Continuous texts are formed by sentences that are in turn organised into paragraphs (e.g., newspaper reports, novels). Non-continuous texts, also known as documents, are composed of a number of lists (e.g., tables, schedules, forms). As regards various aspects of reading, students missed fewer questions that would require them "to access and retrieve" (navigating a text to locate and retrieve a particular piece of explicitly stated information) than for questions requiring them "to integrate and interpret" (processing what is read to make internal sense of a text) and "to reflect and to evaluate" (drawing upon knowledge, ideas or attitudes beyond the text in order to relate the information provided in the text to one's own conceptual and experiential frames of reference).

Table 51. *Types of reading skills that were difficult for low performing students. PISA 2015.*

		Number of difficult questions
Question format	Open constructed	17
	Multiple choice and complex multiple choice	11
	Other	5
Text format	Continuous	19
	Non Continuous	10
	Mixed	4
Aspect	Access and retrieve	5
	Integrate and interpret	17
	Reflect and evaluate	10

Suggestions for strategic action

Both Finnish speaking and Swedish speaking students could improve their skills in reading so that the average performance is higher and that the distribution is tighter. Since the types of comprehension required from reading are seen from the questions that were difficult, teachers can select a variety and complexity of reading materials for use with students. Students can work with the six text types used in daily life:

- Description (e.g., process in a technical manual, catalogue, blog diary)
- Narration (e.g., novel, comic strip, report in a newspaper)
- Exposition (e.g., essay, entry into online encyclopaedia)
- Argumentation (e.g., letter to the editor, posts in an online forum)
- Instruction (e.g., recipe, instructions for operating software)
- Transaction (e.g., personal letter to share news, text message to arrange meeting).

They can also work with students to determine their level of understanding of the texts that are read, by working at different levels of skills so that over time, they can ladder up to higher order skills.

Teachers who also support learning by encouraging students can improve performance

The PISA report of Finland states that social background accounts for about 10 per cent of the variation in performance. In some countries, motivation can overcome some of the influence of social background. Teachers can encourage motivation and self-confidence of students to promote learning.

The graphs (Figures 17–19) show the average performance in science, reading and mathematics of students in each ESCS (the measure of social background used in PISA) quartile by their level of motivation. The lines remained parallel indicating that greater motivation did not result in a jump in performance, attaining the scores of a higher level of social background. But the lines rose with the level of motivation, showing that within each ESCS quartile, that higher motivation resulted in higher performance. Students gained about 50 points if their low motivation was turned to high motivation, about a year or more of schooling. Furthermore, in science, the students with the lowest social background level or ESCS1 and with the highest level of motivation, had a score of 520, which was also the score at the first level of motivation of ESCS3, (two levels higher of social background). In reading, students in ESCS1 with the highest motivation scored 520 which was also the score at the lowest level of motivation for ESCS3. In mathematics, those in ESCS1 with the lowest motivation had a score below the OECD average but those with the highest motivation, exceeded the OECD average.

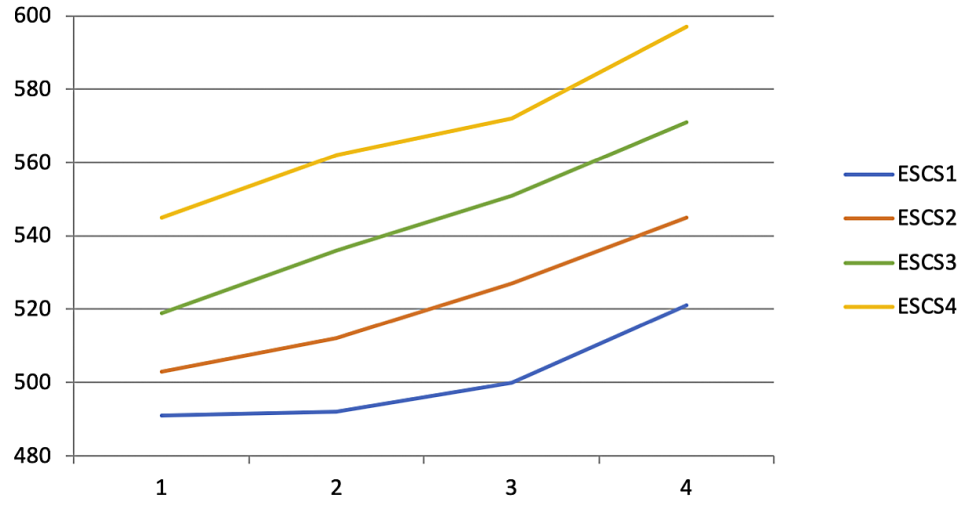


Figure 17. *Impact of motivation on Science performance of students from different social backgrounds measured in ESCS quartiles. PISA 2015.*

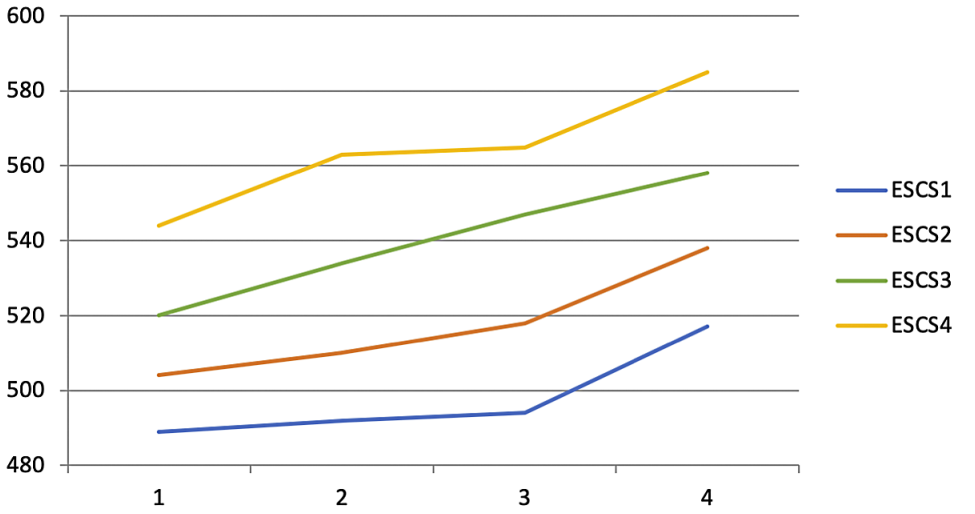


Figure 18. *Impact of motivation on reading performance of students from different social backgrounds measured in ESCS quartiles. PISA 2015.*

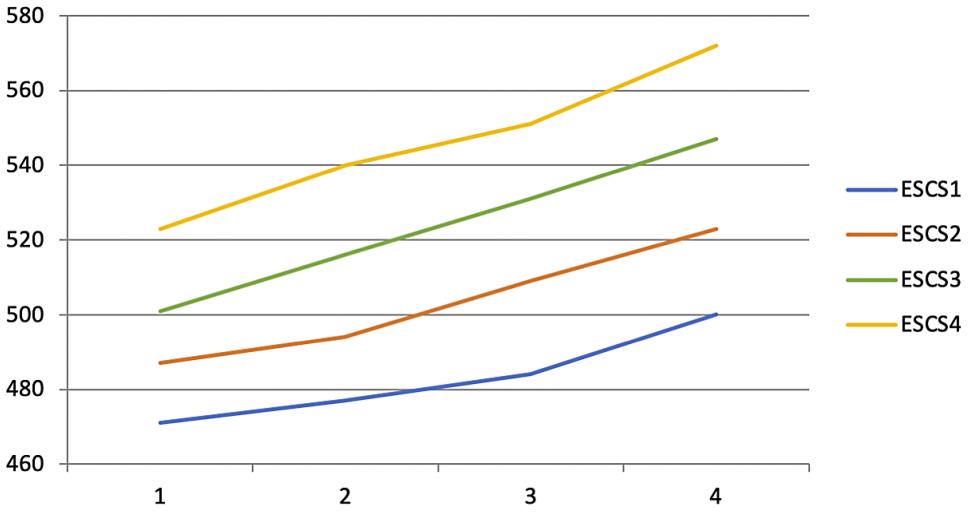


Figure 19. *Impact of motivation on mathematics performance of students from different social backgrounds measured in ESCS quartiles. PISA 2015.*

Suggestions for strategic action

Motivation is a necessary but not a sufficient factor for improving the performance of students. It is not a substitute for good teaching. Motivation of students in the science, reading and mathematics is an enabling factor which appeared to function in the same manner in all four quartiles of the ESCS social background measure. The higher the motivation, the better the result, with a gain of about 50 points (about a year or more of schooling) for students in each of the social background quartiles. Teachers can foster motivation by encouragement and validation, every time a student demonstrates learning, so that improvements can start to grow.

Can teachers improve more students with low social background to reach their full potential?

In 2015, about 29 per cent of disadvantaged students across all PISA countries were considered resilient – meaning that they perform at high levels despite their low social background (OECD 2018). In Finland in 2015, among students with low social background, roughly 7 per cent performed in levels 5 and 6 in science, an indication of resilience (Table 52). (The numbers of Swedish speaking students were few, but in relation to the total, the estimate would be in that range.) These students aimed for university and for higher status occupations whether they were in urban or rural schools. They had good relations with their teachers and enjoyed science.

Table 52. *Number and percentage of Finnish and Swedish speaking students with low social background who scored in level 5 and 6 in science. PISA 2015.*

Students in lowest quartile ESCS	Total 15 year olds	Level 5 and 6 in Science	%
N Finland	1 340	95	7.1
Finnish speaking	1 301	92	7.1
Swedish speaking	39	3	7.7

Suggestions for strategic action

Finland previously did much better in helping students with low social background to excel, a positive result of resilience that is essential for equity. For example, in 2006, in Finland almost 56 per cent of students with low social background performed at level 3 but that level declined sharply, and in 2015, only 39% of such students did so. Hongkong, Macao, Singapore, Estonia, Japan and Canada did better than Finland in resilience. Other countries have improved during the 9 year interval. For example, in 2006, only around one in four disadvantaged students in Germany reached level 3 proficiency or higher in all three academic subjects tested in PISA. By 2015, as many as one in three did (PISA in focus, Number 80, 2018).

Since teachers had better results before in fostering resilience, they certainly have the strategies that can be implemented to do better again. Moreover, if they help a few students to reach levels 5 and 6, they can increase those numbers. At the least they can certainly increase the numbers of students with low social background to achieve level 3 scores. Students can be motivated to enjoy science through teaching based on discovery and students should perceive the classroom as conducive to learning. Teachers can share their pedagogical techniques and class room programs that have been successful in enhancing resilience among students with disadvantaged backgrounds.

Concentration of high and low social background students in schools should be avoided as much as possible

School systems that are undergoing change due to amalgamations and school closures can sometimes inadvertently cause concentration of high or low social background students in particular schools. This could have an unexpected consequence on equity. Concentration of students with high social background could result in elite schools where students perform well but do not have the advantage of social relationships with students from all parts of society. Conversely, in disadvantaged schools, far more effort and resources are required to work intensively with students to ensure that they score above the OECD average (OECD, 2017).

A simple descriptive analysis of the average social background of schools can be seen in the box plot (Figure 20). All 155 Finnish schools in PISA 2015 were ranked according to their average socioeconomic status, measured by Index of Economic, Social and Cultural Status (ESCS). Then they were graphed in the box plot by their rank, with rank one on the extreme left and rank 155 on the extreme right. The boxes show first and third quartile of the distribution and the median (the horizontal line in the box). The extent of the "whiskers" or vertical lines shows the range of socioeconomic status of all students in the school. Therefore, lines above show the number of students in the fourth quartile in each school and the lines below show respectively the first quartile. The shorter the box and whiskers, the more homogeneous is the socioeconomic status of school's students. The Finnish schools are in blue and the Swedish schools are in red.

At present, the schools appeared to have mix of students of different socioeconomic background. Only the top ranked few schools and the lowest ranked few schools had a fairly homogeneous student body. The Swedish schools were ranked fairly high in the sample.

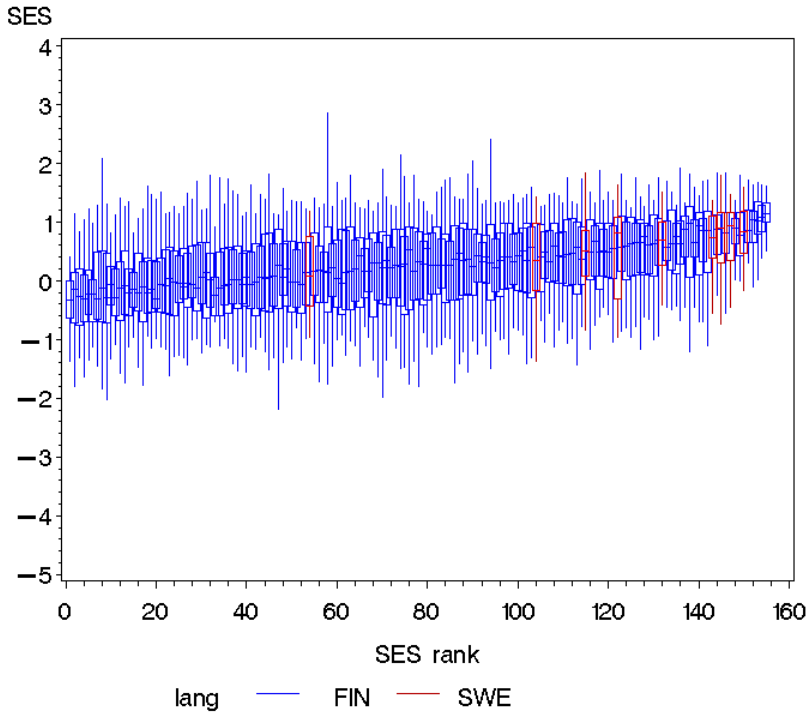


Figure 20. *Box plots of 155 schools in Finland in PISA 2015 according to rank based on their Index of Economic, Social and Cultural Status. Finnish schools in blue, Swedish schools in red.*

If Swedish schools are fairly high in rank based on the ESCS index, based on previous research showing a high positive correlation between high socioeconomic status and performance, they should have high scores.

The relationship between school average science scores in 2015 and average school social background level (measured using the Index of Economic, Social and Cultural Status) were examined using a scatter plots. This also provided an indication of how well teachers in the schools were able to mitigate the effects of social background and increase resilience (Figure 21).

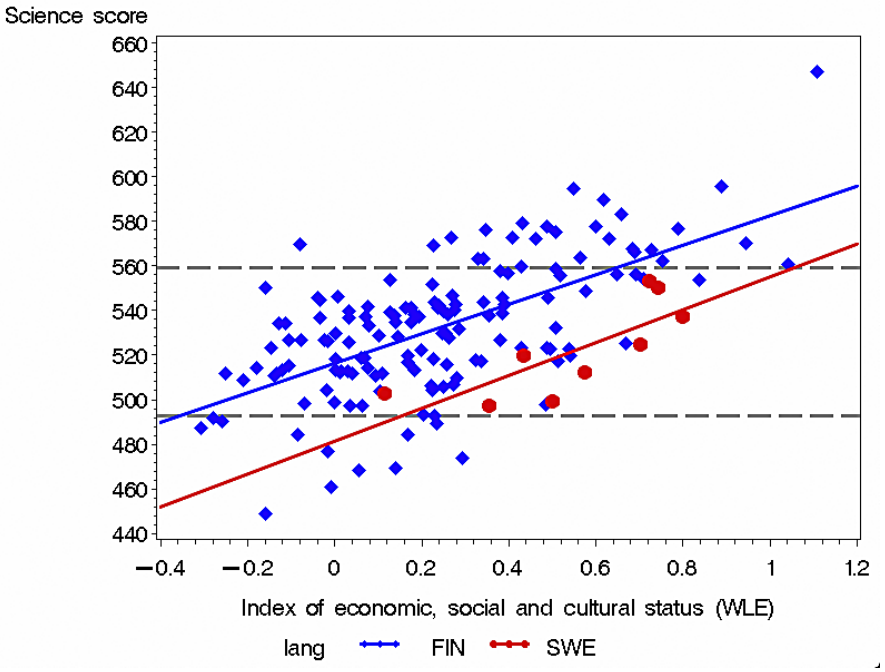


Figure 21. *Scatter plot with Index of economic, social and cultural status of Finnish speaking and Swedish speaking schools and their average science scores. PISA 2015.*

Schools with average science scores at level 5 and above (over 560) are above the upper dashed line. Schools above the upper dashed line that are on the left (below 0) have an lower average social background than schools on the right. There was at least one school with a lower average social background that had an average science score at level 5 which shows that this school was able to overcome the low socioeconomic average of the school and attain a high average score in science. As expected, there were more schools to the right with higher average social backgrounds that had average scores at level 5 or above.

Schools that score below the OECD average score for science are shown below the lower dashed line. These schools tended to fall at the lower end of the socioeconomic scale.

The Swedish schools in the sample do not appear to be elite schools like the top five Finnish schools but they had a fairly high average socioeconomic background. All the Swedish schools that were sampled in PISA 2015 had average scores above the OECD average but none of them had average scores that were at level 5 and above. Many Finnish

schools which had the same or similar average social background as the Swedish schools had higher average Science scores, many of them with averages at level 5 and above.

The trend lines for Finnish (blue) and Swedish schools (red) show that there was a positive relationship between the average social background of the school and the average science score of the school. Since the trend lines were almost parallel, the difference in scores between Finnish and Swedish students was practically constant regardless of the level of average social background of the school. The reasons for this were not apparent, especially because aggregation of social background for schools is a crude measure for predicting results for individual students since only some students are sampled.

The trend line for the relationship between the reading and mathematics scores of the Finnish and Swedish speaking students and the average social background of the schools was checked to compare with the results for science.

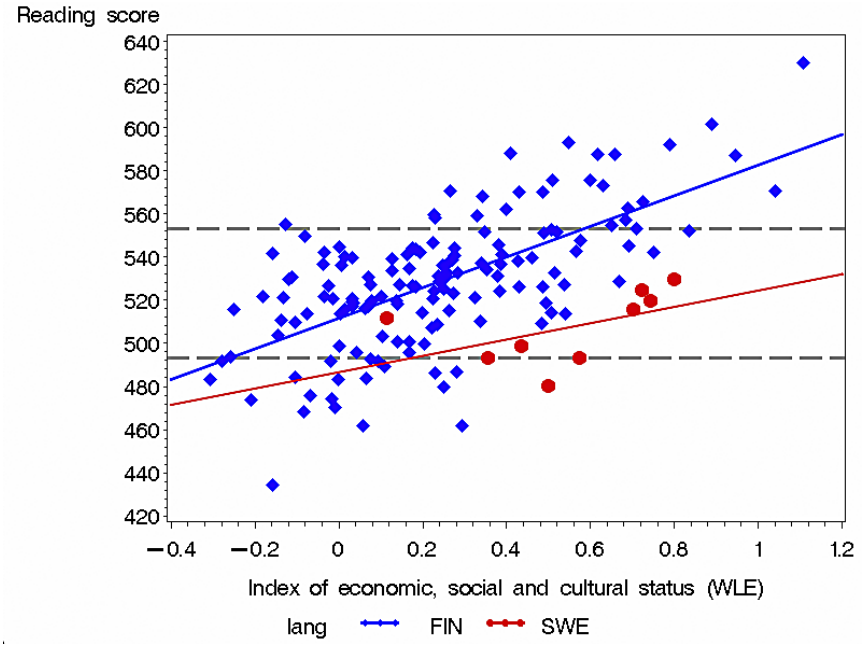


Figure 22. *Scatter plot with Index of economic, social and cultural status of Finnish speaking and Swedish speaking schools and their average reading scores. PISA 2015.*

In reading (Figure 22) only one of the schools in the lower end of the social background scale had an average reading score at level 5 and above but the top performing Finnish school had an average that was about 70 points over the cut-off for level 5. No Swedish schools had averages at level 5 or above and Finnish schools with similar average social backgrounds had much higher average scores. There were three Swedish schools that had averages in reading that were at the OECD average or below even though they had a fairly high average social background. Several Finnish schools also had school average reading

scores below the OECD average but they had lower average social backgrounds than the Swedish schools.

The trend line for the Finnish schools is steep compared to the trend line for Swedish schools. This suggests that in reading, the effect of the average social background in schools is far greater in Finnish schools than in Swedish schools and that the impact is higher with rising social background.

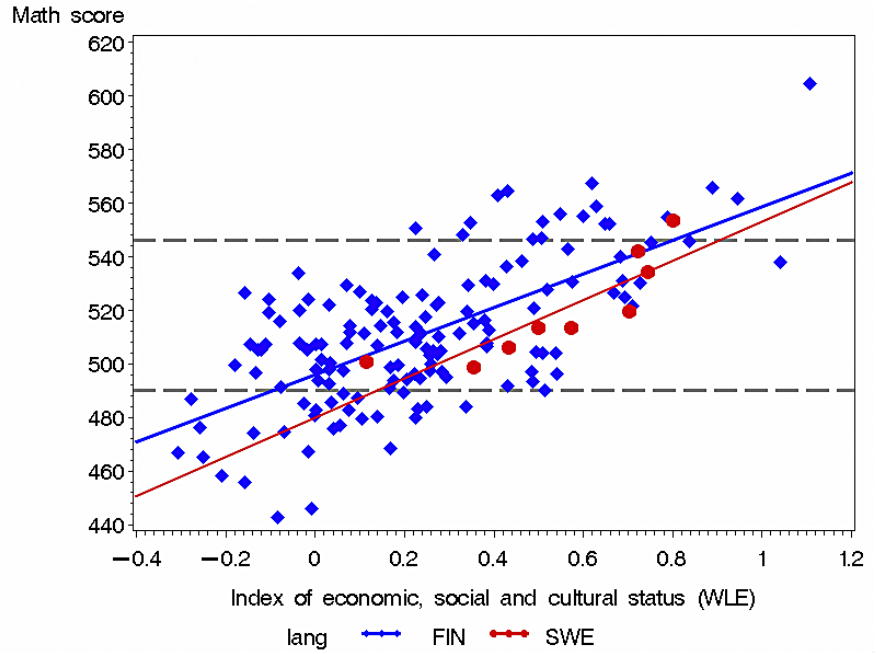


Figure 23. *Scatter plot with Index of economic, social and cultural status of Finnish speaking and Swedish speaking schools and their average mathematics scores. PISA 2015.*

The scatter plot for mathematics (Figure 23) does not reflect the higher average performance in mathematics of the Swedish students. This is mainly because the plot is drawn at school level, and the small number of students in certain Swedish schools does not manifest in the graph. In mathematics, none of the schools in the lower end of the social background scale had an average reading score at level 5 and above but several schools with higher average social background had high average scores. The Swedish school with the highest average social background achieved a mathematics average at level 5 or above and none of the Swedish schools had mathematics score averages below the OECD average. Unlike in the cases of science and reading, very few Finnish schools with similar average social backgrounds as Swedish schools had higher average scores in mathematics and in fact, many Finnish schools clustered around averages that fell between 490 and 530. Several Finnish schools also had school average mathematics scores below the OECD average but they mostly had lower average social backgrounds than the Swedish schools.

The trend line for the Swedish schools is steeper than the trend line for Finnish schools but both trend lines are steeper than for science or reading. This suggests that the effect of the average social background in schools on average mathematics scores is higher at the upper end of the scale for both Finnish and Swedish schools.

Suggestions for strategic action

The schools in Finland appeared to have a mix of students from various socioeconomic backgrounds, except for a few schools. It would be worthwhile to monitor the socioeconomic status periodically in the future to avoid concentrations by social background of students.

The Swedish schools in the PISA 2015 sample had a fairly high average social background. However, Finnish schools with a similar average social background had higher average science and reading scores. Though Swedish schools are administered in a separate system, it would be valuable to learn from similar schools in the Finnish system how science and reading are taught in the classroom.

Subject matter teachers need to be conscious of the relationship between social background and student scores. Individualized teaching and early intervention for students who are struggling will help to reduce the difference due to social background. They can also increase resilience among students with low social background.

Performance will improve if weaker schools performed better

As discussed above, a positive skew with larger numbers in the performance levels of 4, 5 and 6 and fewer students who are low performers are characteristics of high performing countries. The focus should be to raise the probability that students will excel regardless of the school they attend.

The difference between the school averages in science between the strongest and weakest Finnish and Swedish speaking schools was examined (Table 53). A few schools with very high scores drew up the Finnish score. The difference between the strongest Finnish speaking school (647) and the average for Finland (531) was 116 points and the difference between the weakest Finnish speaking school (449) and Finland's average was 82 points. Considering that about 40 points equal a year of schooling, there is a very wide range among Finnish speaking schools. The difference between the strongest Swedish speaking school (553) and Finland's average was 22 points and the difference between the weakest Swedish speaking school (497) and Finland's average was 34. The difference between the strongest Swedish speaking school and the weakest was about one year of schooling. Based on this, the Swedish system of schools is more equitable than the Finnish system of schools but it should be remembered that the sample of Swedish schools was small.

Table 53. *The average science scores of the strongest and weakest Finnish speaking and Swedish speaking schools. PISA 2015.*

System	Schools	Science	Level	Reading	Level	Mathematics	Level
Finnish speaking	Strongest	647	5	630	5	604	4
	Weakest	449	2	434	2	456	2
Difference		198		196		148	
Swedish speaking	Strongest	553	3	525	3	542	3
	Weakest	497	3	493	3	499	3
Difference		56		32		43	

The average of the weakest Finnish speaking school fell well below the OECD average but the average of the weakest Swedish speaking school was slightly above the OECD average (Table 54).

Table 54. *The difference between the OECD average and the scores of the weakest Finnish and Swedish speaking schools. PISA 2015.*

OECD average in science	Finnish speaking weakest school average	Swedish speaking weakest school average
481	449 – below OECD average	497 – above OECD average

Some of the characteristics that were associated with these strong schools compared to weak schools, whether Finnish or Swedish speaking, were:

- Both parents of students had university degrees
- Parents were of high social background
- Home had higher cultural possessions and books
- School had high autonomy
- More teachers had professional development
- More computers available for students
- High percentage of parents participated in school activities

At first blush, it would appear that weaker and average schools should emulate the strongest schools that could serve as a model. But before making that claim it would be important to examine these schools more closely to see if they are appropriate models. Are these elite schools or private schools with admission criteria that select the best students or from families of high social background? The analyses of the sample show that these few "special" schools that always use admission criteria have an average score which is about 20 points higher than schools that have no admission criteria (Table 55). They formed between 10 to 30 per cent of the sample schools.

Table 55. *Mean scores of schools which always or never use admission criteria of student's previous academic performance and student's interest in special programs (e.g. music, art). PISA 2015.*

			Mean scores		
Use admission criteria	**Total number of schools**	**Number of students**	**Science**	**Mathematics**	**Reading**
Never	81	3 014	525	505	519
Sometimes	59	2 217	538	518	536
Always	15	502	547	527	541
Total	155	5 733			
	Total number of Finnish speaking schools	**Number of students**	**Science**	**Mathematics**	**Reading**
Never	75	2795	526	504	520
Sometimes	58	2178	538	518	536
Always	12	417	548	526	546
Total	145	5 390			
	Total number of Swedish speaking schools	**Number of students**	**Science**	**Mathematics**	**Reading**
Never	6	219	515	512	504
Sometimes	1	39	537	553	530
Always	3	85	540	531	515
Total	10	343			

Note: Analysis of secondary schools only. Upper secondary schools and special schools for disabled students were omitted.

Suggestions for strategic action

Ideally equity means that a child could attend any school in the country and be guaranteed a good education with excellent and equal outcomes.

It is no surprise that schools that use admission criteria perform better and this is probably similar to other countries. However, when the great majority are regular schools across the country, equity can only be a reality if all schools have excellent results. Performance will certainly improve if weaker schools could raise their average scores. Raising average scores by about 20 points is achievable given time.

The number of schools that state that they sometimes use admission criteria may reflect the phenomenon where schools have special criteria within the school for a special program, perhaps for music or sport. This could be positive, where the talents of children can be developed in the community school. However, these schools should still focus on the equitable results for all students in the school for these three foundation subjects.

Overarchingly, this also means that in addition to academic efforts, it is important for municipalities and school directors to also improve the other variables associated with good schools such as high school autonomy, professional development for teachers, more educational resources such as computers and to engage more parents to participate in school activities. It does not, however, mean that more schools should use admission criteria, nor does it mean that there should be more special schools. Natural student diversity in schools must be managed positively so every student acquires the competences in compulsory school to become what they aspire to be.

Coordinated efforts to improve performance in science based on key factors affecting the score

No single variable is totally responsible for achievement in science. Therefore, it is important to look at the effects of different variables simultaneously. Some of the variables may have important effects but may not be policy malleable, such as gender, in which case policies should be responsive to the differences. Variables may be associated with students, their families, teachers and the classroom.

Multivariate linear regression analyses were performed to investigate which background factors were the most important in explaining the variation of student performance in science. Proficiency in science was chosen as the dependent variable since science was the major domain of PISA 2015 assessment. A number of background variables from the student and school questionnaires were introduced as independent variables in the regression models. The models were fitted separately for Finnish and Swedish speaking boys and girls (models for four subgroups altogether). The models in Table 56 were selected using the backward elimination approach, that is, all non-significant variables were dropped from the model step by step. Thus, the models contain significant effects only. Beta is the standardized regression coefficient.

Table 56. *Regression analyses for science proficiency for Finnish and Swedish speaking boys and girls. PISA 2015.*

Swedish-speaking girls	coeff	s.e.	t test	sig	beta
student's achievement motivation	21.40	6.71	3.19	p<0.01	0.22
number of books at student's home	15.06	4.06	3.71	p<0.001	0.21
student behavior hindering learning at school	-22.88	9.60	-2.38	p<0.05	-0.19
parental occupational status	0.76	0.34	2.28	p<0.05	0.18
student's enjoyment of science	13.89	5.75	2.41	p<0.05	0.17
student aims at university	27.75	12.63	1.96	p<0.05	0.16
good teacher-student relations	25.82	8.62	2.99	p<0.01	0.14
R-square = 0.38					

Swedish-speaking boys	**coeff**	**s.e.**	**t test**	**sig**	**beta**
good teacher-student relations	41.06	10.52	3.90	p<0.001	0.30
student aims at university	57.98	12.62	4.60	p<0.001	0.28
active ICT entertainment use	-23.78	4.52	-5.27	p<0.001	-0.26
student's achievement motivation	18.75	6.18	3.03	p<0.01	0.17
immigrant status	-78.83	23.56	-3.35	p<0.001	-0.15
R-square = 0.31					
Finnish-speaking girls	**coeff**	**s.e.**	**t test**	**sig**	**beta**
number of books at student's home	12.68	1.52	8.32	p<0.001	0.19
good teacher-student relations	26.56	3.33	7.97	p<0.001	0.16
student aims at university	27.03	4.17	6.48	p<0.001	0.14
student's enjoyment of science	13.46	2.27	5.93	p<0.001	0.14
student's expected occupational status	0.55	0.10	5.53	p<0.001	0.13
immigrant status	-66.08	16.22	-4.07	p<0.001	-0.13
parental occupational status	0.45	0.09	4.74	p<0.001	0.10
student's achievement motivation	8.85	2.35	3.77	p<0.001	0.09
R-square = 0.35					
Finnish-speaking boys	**coeff**	**s.e.**	**t test**	**sig**	**beta**
student's expected occupational status	0.93	0.12	8.02	p<0.001	0.17
good teacher-student relations	23.90	3.41	7.01	p<0.001	0.16
immigrant status	-74.50	12.04	-6.19	p<0.001	-0.16
student's enjoyment of science	14.80	2.18	6.80	p<0.001	0.15
number of books at student's home	10.42	1.82	5.74	p<0.001	0.14
no aim at secondary school	-28.27	5.57	5.07	p<0.001	-0.11
student aims at university	24.82	5.23	4.74	p<0.001	0.10
parental occupational status	0.28	0.12	2.43	p<0.05	0.06
active ICT entertainment use	-4.98	2.39	-2.09	p<0.05	-0.05
R-square = 0.32					

For each model, the share of explained variation is reasonably high, more than 30 per cent. The final models of the four subgroups are not completely identical, but they do have a few variables in common.

Table 57. *Common variables explaining the variation in scores for Finnish and Swedish speaking boys and girls. PISA 2015.*

	Common variable	Finnish speaking		Swedish speaking	
		Boys	Girls	Boys	Girls
Student related	Aims at university	x	x	x	x
Student related	Enjoyment of science	x	x		x
Student related	Achievement motivation		x	x	x
Student/family related	Immigrant status	x	x	x	
Student related	ICT entertainment use	-x		-x	
Student related	Expected occupational status	x	x		
Family related	Number of books at home	x	x		x
Family related	Parental occupational status	x	x		x
Class room related	Good teacher-student relations	x	x	x	x

Two variables, good teacher-student relations and aiming at university had significant positive effects in all subgroups. Number of books at home, as well as parental occupational status and enjoying science were positively associated with good performance in all groups except for Swedish speaking boys. Achievement motivation also had a positive effect on the science proficiency in most of the groups. Immigrant status was related to lower performance except for Swedish speaking girls (there might have been very few students with immigrant background in this subgroup). It is interesting that the negative effect of ICT use for entertainment only appears in the models for boys. Students' expected occupational status (the status of the job which the student expects to have at the age of thirty) predicted good performance among the Finnish speaking students.

Suggestions for strategic action

The results can be categorized according to the areas of responsibility. Priorities can be directed to areas which can affect all students. For example, parents and teachers can support students to aim for further education, even university. Strategies can be designed by group. For instance, more teacher professional training can be developed to work with immigrant students, which was probably not provided when they earned their credentials since there were not as many immigrants earlier. Teaching strategies can build on the interest of students. Since ICT entertainment is of male interest, perhaps game based teaching for science may work as a strategy to increase the enjoyment of Science (BBC News 2013).

Education is a long term multi-actor process and all parties, students, parents, teachers, principals, municipalities and the national education Ministry and its agencies should to make a coordinated effort to get optimum results. Students need to learn to enjoy science by exposure to real life situations. Parents should be engaged with schools and the learning of their children. Teachers should use individualized teaching methods to reach

each student according to their pace of learning. Principals should make their schools autonomous to best serve the students in the community. Municipalities should ensure that schools are well resourced and funded. The national government should provide direction, support and additional assistance wherever it is needed.

The skill performance of youth in Finland after PISA

The OECD which manages PISA, also implements the Programme for International Assessment of Adult competencies or PIAAC, a highly complex survey of the information-processing skills of youth and adults between the ages of 16 and 65. Finland was one of the 24 countries that participated in 2012. PIAAC also assessed literacy and numeracy so it is possible to examine the performance of young adults in those two domains. The scores in PIAAC are not directly comparable to PISA but the scores of PIAAC are also classified into 6 levels, based on the complexity of the tasks in reading and mathematics. Finland ranked second in literacy and numeracy, after Japan, so there are parallels with PISA.

By examining the average performance of young adults by age groups, one can see how men and women develop after the age of 15 as they move into higher education and work. The Swedish speaking population was not oversampled so results of analyses should be considered indicative. Tests of significance can be affected by the small sample also. Figure 24 graphs the literacy (similar to reading in PISA) performance of Finnish and Swedish speaking young adults beyond the age of 15.

All literacy averages were at level 3, the level of competence considered necessary for functioning in modern economies. During these years, the average of Finnish speakers rose by 18 points (significant) and that of Swedish speakers by 21 points. At age 16, one year after PISA at age 15, Swedish speaking youth score slightly below Finnish speaking youth in Literacy, as they did in reading in PISA. However, the difference between Swedish speakers and Finnish speakers grew at ages 20 to 24 years. But by age 25 to 29, Swedish speakers were able to equal and to slightly surpass the Finnish speakers. It should be noted that at the critical ages where youth undertake higher education or start their careers, there is a difference of 13 points, however, it was not statistically significant.

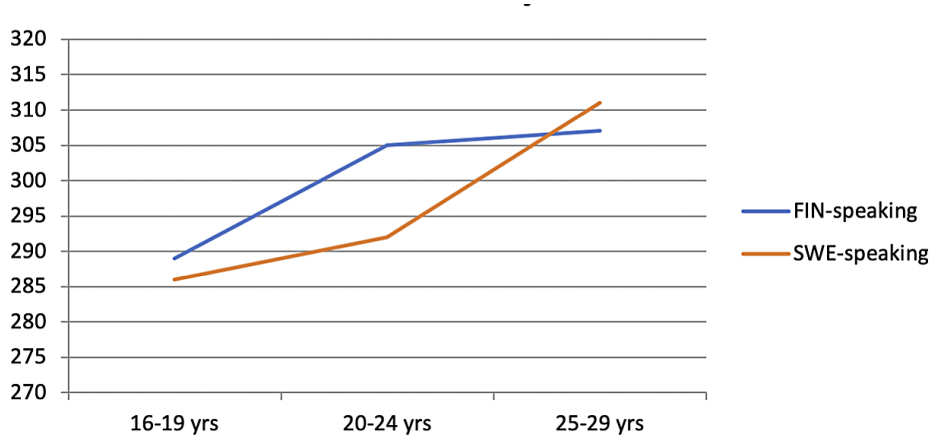


Figure 24. *Literacy scores of Finnish speaking and Swedish speaking youth in three age groups beyond 15 years. PIAAC 2012.*

The pattern for numeracy was similar (Figure 25). All averages were at level 3, considered the requirement for functioning in a modern economy. During the years between 16 and 29, the average of Finnish speakers grew by 25 points (significant) and that of Swedish speakers by 31 points. At age 16, as in mathematics at age 15 in PISA, Swedish speakers performed slightly better in numeracy than Finnish speakers. But, at age 20 to 24, the average for Finnish speakers was 8 points higher. At ages 25 to 29, Swedish speakers regained the advantage and their average scores were 8 points higher. In numeracy as well, Swedish speakers were at a slight disadvantage when they pursued higher education and started their careers but fortunately the difference is not large.

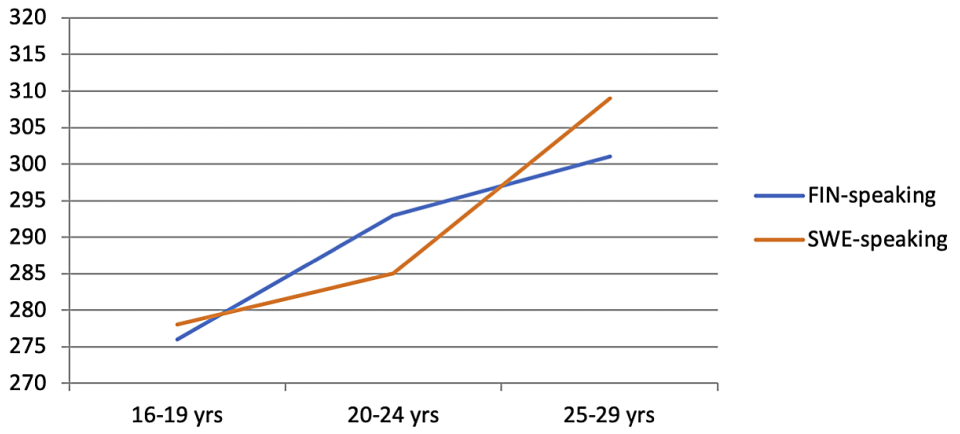


Figure 25. *Numeracy scores of Finnish speaking and Swedish speaking youth in three age groups beyond 15 years. PIAAC 2012.*

The differences between Finnish and Swedish speaking men and women can also be scrutinized (Table 58). At 16 to 19, Finnish speaking men had a slightly higher average in literacy than Swedish speaking men. However, Swedish women had the edge over Finnish women. The pattern seemed to reverse at age 25 to 29 when Swedish speaking men had a slightly higher average than Finnish speaking men and the average for Finnish speaking women were a few points higher than Swedish women.

At the ages of 16 to 19, Swedish speaking women had the highest score in numeracy but the averages for the four groups were similar. By the ages of 25 to 29, the average of Swedish speaking men gained 45 points while the average for Finnish men rose by 26 points in numeracy. The average for Swedish speaking women increased by 11 points after a drastic drop at the ages of 20 to 24, which could be a statistical artifact. The average for Finnish speaking women rose by 22 points.

Table 58. *Average literacy and numeracy scores of Finnish speaking and Finnish speaking men and women. PIAAC 2012.*

	Literacy			Numeracy		
Age group	16–19	20–24	25–29	16–19	20–24	25–29
Finnish speaking men	284	309	304	279	303	305
Finnish speaking women	293	302	311	274	283	296
Swedish speaking men	277	301	313	275	301	320
Swedish speaking women	299	282	307	282	268	293

Suggestions for strategic action

It is comforting to know that Finnish and Swedish speaking men and women use their learning skills to improve their performance in the years following compulsory education. It is well known that there is loss of performance with age but if the habit of continuous learning continues, this loss can be prevented or reduced.

Both Finnish and Swedish speaking men and women have an average at level 3, which is a solid foundation for future learning and work. It is an indication that their compulsory education has provided them with the skills needed to thrive at meeting the most common demands of the modern economy.

Though there are some differences in the average scores, in general there is equity between Finnish and Swedish speaking men and women. The rates of growth in the average scores for the four groups appear to proceed at a similar pace. This is important for achieving equity of results from the opportunities for further education and careers.

Future effort should be directed to maintaining this well performing position in PIAAC. The next assessment will follow PISA 2021 and will be held in 2022. It will be one year following PISA 2021 and it is possible that some of those tested in PISA will also be in the sam-

ple for PIAAC. If compulsory education is improved, it could provide a boost and lift Finland into first place in PIAAC. But more importantly, the improved performance in compulsory education is to ensure that self-directed learning successfully continues throughout the sixty or more years of life after schooling because there will be demanding developments in knowledge and technology in the twenty first century.

Conclusion

Finland is admired around the world for its achievements in excellence and equity in compulsory education but its performance has been diminishing since 2006 compared to 2000. Excellence has lost ground, while equity is still achieved. The results of PISA 2018 will show if the decline has halted.

Some actions have been taken in response, such as the new curriculum. But more vigorous and quick actions should be taken to reverse the decade long deterioration to recover its status as a top performing country. Finland has changed in the 15 years since it first participated in PISA 2000 when it ranked first in the PISA domains. Small schools have closed and class rooms are more diverse in terms of background, attitudes and capabilities of students. PISA 2015 results have yielded a number of suggestions about what actions could be taken and what variables should be targeted. Small improvements at the start could lead to accelerating growth. Improvements in performance can be achieved by small additional costs for time-limited targeted policies to complement national universal policies to improve performance. While the emphasis is still to graduate a cohort of well-rounded students, with high average performance in the foundation subjects, the means to achieve this goal is to individualize teaching and to maximize learning of each student to his or her potential. A well-focused and coordinated effort by all those involved in education is necessary to, on the one hand, raise and exceed the average performance of students in Finnish speaking schools to previous levels and on the other, to increase the performance of students in Swedish speaking schools to the same high levels. It is also to monitor the performance of low performers, whether they be boys, immigrants or those of low social background and to intervene early to change their trajectory of learning. Research has shown that equity and excellence go hand in hand in top performing countries. Finland could serve as a respected model again, if it improves both equity and excellence.

References

Autti, O., & Hyry-Beihammer, E. K. (2014). School closures in rural Finnish communities. Journal of Research in Rural Education, 29(1), 1–17.

BBC News (2013). How to use games to teach physics. 25 March. (http://www.bbc.com/news/technology-21898927

Brink, S., Nissinen, K. & Vettenranta, J. (2013). Equity and excellence. Evidence for policy formulation to reduce the difference in PISA performance between Swedish speaking and Finnish speaking students in Finland. Finnish Institute for Educational Research. Report 47. Jyväskylä: University of Jyväskylä.

Finnish National Agency for Education (2017). Finnish Education in a nutshell. Helsinki: Finnish National Agency for Education.

Harju-Luukkainen, H., Vettenranta, J., Ouakrim-Soivio, N. & Bernelius, V. (2016). Differences between students' PISA reading literacy scores and grading for mother tongue and literature at school: A geostatistical analysis of the Finnish PISA 2009 data. Education Inquiry Vol. 7, No. 4, December 2016, 463–479.

Karlsson, F. (2017). The languages of Finland 1917–2017. Turku: Lingsoft Inc

Kupari, P., Välijärvi, J., Andersson, L., Arffman, I., Nissinen, K., Puhakka, E. & Vettenranta J. (2013). PISA 2012 ensituloksia [PISA 2012 initial results]. Helsinki: Opetus- ja kulttuuriministeriön julkaisuja 2013:20. (in Finnish)

Kuusela, J. (2006). Temaattisia näkökulmia perusopetuksen tasa-arvoon [Thematic viewpoints on the equality of basic education]. Oppimistulosten arviointi 6/2006. Helsinki: Opetushallitus. (in Finnish)

OECD (2010a). PISA 2009 results: Learning to learn: student engagement, strategies and practices (Volume 3). Paris: OECD.

OECD (2010b). PISA 2009 results: Learning trends: Changes in student performance since 2000 (Volume 5). Paris: OECD.

OECD (2013). What makes urban schools different? PISA in Focus. Number 27. May 2013. Paris: OECD.

OECD (2016). PISA 2015 Results (Volume I): Excellence and Equity in Education. Paris: OECD.

OECD (2017). How do schools compensate for socio-economic disadvantage? PISA in Focus. Number 76. September 2017. Paris: OECD

OECD (2018). In which countries and schools do disadvantaged students succeed? PISA in focus. Number 80. January 2018. Paris: OECD

Official Statistics of Finland (OSF) (2018). Providers of education and educational institutions [e-publication] ISSN=1799-5825. 2017. Helsinki: Statistics Finland Published: 11.5.2018.

Vettenranta, J., Välijärvi, J., Ahonen, A., Hautamäki, J., Hiltunen, J., Leino, K., Lähteinen, S., Nissinen, K., Nissinen, V., Puhakka, E., Rautopuro, J. and Vainikainen, M. (2016). PISA 15 ensituloksia. Huipulla pudotuksesta Huolimatta. Helsinki: Opetus- ja kulttuuriministeriön julkaisuja 2016:41.

Välijärvi, J., Linnakylä. P., Kupari, P., Reinikainen, P. & Arffman, I. (2002). The Finnish Success in PISA – Some reasons behind it. Finnish Institute for Educational Research. Jyväskylä: University of Jyväskylä.

Yle Nyheter (2017). Skolnätet glesnar – en av fem skolor är borta. 23.03.2017. (in Swedish)

Appendices

Appendix 1 Summary description of the seven levels of proficiency in Science in PISA 2015

Level	Lower score limit	Characteristics of tasks
6	708	At level 6, students can draw on a range of interrelated scientific ideas and concepts from the physical, life, earth and space sciences and use content, procedural and epistemic knowledge in order to offer explanatory hypotheses of novel scientific phenomena, events and processes or to make predications. In interpreting data and evidence, they are able to discriminate between relevant and irrelevant information and can draw on knowledge external to the normal school curriculum. They can distinguish between arguments that are based on scientific evidence and theory and those based on other considerations. Level 6 students can evaluate competing designs of complex experiments, field studies or simulations and justify their choices.
5	633	At level 5, students can use abstract scientific ideas or concepts to explain unfamiliar and more complex phenomena, events and process involving multiple causal links. They are able to apply more sophisticated epistemic knowledge to interpret information or make predictions. Level 5 students can evaluate ways of exploring a given question scientifically and identify limitations in interpretations of data sets including sources and the effects of uncertainty in scientific data.
4	559	At level 4, students can use more complex or more abstract content knowledge, which is either provided or recalled, to construct explanations of more complex or less familiar events and processes. They can conduct experiments involving two or more independent variables in a constrained context. They are able to justify an experimental design, drawing on elements of procedural and epistemic knowledge. Level 4 students can interpret data drawn from a moderately complex data set or less familiar context, draw appropriate conclusions that go beyond the data and provide justifications for their choices.
3	484	At level 3, students can draw upon moderately complex content knowledge to identify or construct explanations of familiar phenomena. In less familiar or more complex situations, they can construct explanations with relevant cueing or support. They can draw on elements of procedural or epistemic knowledge to carry out a simple experiment in a constrained context. Level 3 students are able to distinguish between scientific and non-scientific issues and identify the evidence supporting a scientific claim.
2	410	At level 2, students are able to draw of everyday content knowledge and basic procedural knowledge to identify an appropriate scientific explanation, interpret data, and identify the question being addressed in a simple experimental design. They can use basic or everyday scientific knowledge to identify a valid conclusion from a simple data set. Level 2 student demonstrate basic epistemic knowledge to identify a valid conclusion from a simple data set. Level 2 students demonstrate basic epistemic knowledge by being able to identify questions that can be investigated scientifically.

1a	335	At level 1a, students are able to use basic or everyday content and procedural knowledge to recognize or identify explanations of simple scientific phenomenon. With support, they can undertake structured scientific enquiries with no more than two variables. They are able to identify simple causal or correlational relationships and interpret graphical and visual data that require a low level of cognitive demand. Level 1a students can select the best scientific explanation for given data in familiar personal, local and global contexts.
1b	261	At level 1b, students can use basic or everyday scientific knowledge to recognize aspects of familiar or simple phenomenon. They are able to identify simple pattern of data, recognise basic scientific terms and follow explicit instructions to carry out a scientific procedure.

Source: OECD, 2016

Appendix 2 Summary description of the seven levels of proficiency in Reading in PISA 2015

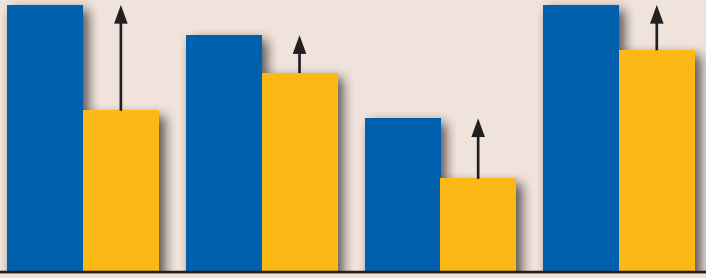
Level	Lower score limit	Characteristics of tasks
6	698	Tasks at this level typically require the reader to make multiple inferences, comparisons and contrasts that are both detailed and precise. They require a full and detailed understanding of one or more texts and may involve integrating information from more than one text. Tasks may require the reader to deal with unfamiliar ideas in the presence of prominent competing information and to generate abstract categories for interpretations. Reflect and evaluate tasks may require the reader to hypothesise about or critically evaluate a complex text on an unfamiliar topic, taking into account multiple criteria or perspectives and applying sophisticated understanding from beyond the text. A salient condition for access and retrieve tasks at this level is precision of analysis and fine attention to detail that is inconspicuous in the texts.
5	626	Tasks at this level that involves retrieving information require the reader to locate and organise several pieces of deeply embedded information, inferring which information in the text is relevant. Reflective tasks require critical evaluation or hypothesis formulation, drawing on specialised knowledge. Both interpretative and reflective tasks require a full detailed understanding of a text whose content or form is unfamiliar. For all aspects of reading, tasks at this level typically involve dealing with concepts that are contrary to expectations.
4	553	Tasks at this level that involve retrieving information require the reader to locate and organize several pieces of embedded information. Some tasks at this level require interpreting the meaning of nuances of language in a section of text by taking into account the text as a whole. Other interpretative tasks require understanding and applying categories in an unfamiliar context. Reflective tasks at this level require readers to use formal or public knowledge to hypothesise about or critically evaluate a text. Readers must demonstrate an accurate understanding of long or complex texts whose content or form may be unfamiliar.
3	480	Tasks at this level require the reader to locate, and in some cases recognize the relationship between several pieces of information that must meet multiple conditions. Interpretative tasks at this level require the reader to integrate several parts of a text in order to identify a main idea, understand a relationship or construe the meaning of a word or phrase. They need o take into account many features in comparing, contrasting or categorising. Often the required information is not prominent or there is much competing information; or there are other text obstacles such as ideas that are contrary to expectations or negatively worded. Reflective tasks at this level may require connections, comparisons and explanations or they may require the reader to evaluate a feature of the text. Some reflective tasks require readers to demonstrate a fine understanding of the text in relation to familiar text. Some reflective tasks require readers to demonstrate a fine understanding of the text in relation to familiar, everyday knowledge. Other tasks do not require detailed text comprehension but the require the reader to draw on less common knowledge.

2	407	Some tasks at this level require the reader to locate one or more pieces of information which may need to be inferred and may need to meet several conditions. Others require recognizing the main idea in a text understanding or construing meaning with a limited part of the text when information is not prominent and the reader must make low level inferences. Tasks at this level may involve comparisons or contrasts, based on a single feature in the text. Typical reflective tasks at this level require readers to make a comparisons or several connections between the text and outside knowledge, by drawing on personal experience and attitudes.
1a	335	Tasks at this level require the reader to locate on or more independent pieces of explicitly stated information to recognise the main theme or author's purpose in a text about a familiar topic or to make a simple connection between information in the text and common, everyday knowledge. Typically, the required information in the text is prominent and there is little, if any, competing information. The reader is explicitly directed to consider relevant factors in the task and in the text.
1b	262	Tasks at this level require the reader to locate a single piece of explicitly stated information in a prominent position in a short, syntactically simple text with a familiar context and text type, such as narrative or a simple list. The text typically provides support to the reader, such as repetition of information, pictures or familiar symbols. There is minimal competing information. In tasks requiring interpretation, the reader may need to make simple connections between adjacent pieces of information.

Source: OECD, 2016

Appendix 3 Summary description of the six levels of proficiency in Mathematics in PISA 2015

Level	Lower score limit	Characteristics of tasks
6	669	At level 6, students can conceptualise, generalise and utilise information based on their investigations and modelling of complex problem situations and can use their knowledge in relatively non-standard contexts. They can link different information sources and representations and flexibly translate among them. Students at this level are capable of advanced mathematical thinking and reasoning. These students can apply this insight and understanding, along with a mastery of symbolic and formal mathematical operations and relations, to develop new approaches and strategies for attacking novel situations. Students at this level can reflect on their actions and arguments, and the appropriateness of these to the original situation.
5	607	At level 5, students can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad well developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations and insight pertaining to these situations. They begin to reflect on their work and can formulate and communicate their interpretations and reasoning.
4	545	At level 4, students can work effectively with explicit models for complex, concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations including symbolic, linking them directly to aspects of real-world situations. Students at this level can utilise their limited range of skills and reason with some insight in straightforward contexts. They can construct and communicate explanations and arguments based on their interpretations arguments and actions.
3	482	At level 3, students can execute clearly described procedures, including those that require sequential decisions. Their interpretations are sufficiently sound to be a base for building a simple model, or for selecting and applying simple problem-solving strategies. Students at this level can interpret and use representations based on different information sources and reason directly from them. They typically show some ability to handle percentages, fractions and decimal numbers and to work with proportional relationships. Their solutions reflect that they have engaged in basic interpretation and reasoning.
2	420	At level 2, students can interpret and recognize situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures or conventions to solve problems involving whole numbers. They are capable of making literal interpretations of the results.
1	358	At level 1, students can answer questions involving familiar contexts were all relevant information is present and the questions are clearly defined. They are able to identify information and to carry our routine procedures according to direct instructions in explicit situations. They can perform actions that are almost always obvious and follow immediately from the given stimuli.



IN 2013, THE AUTHORS prepared a comparative report on Swedish speaking and Finnish speaking students' performance in PISA 2009 and asked if Finland could achieve both excellence and equality goals in education in the coming decade. Five years later, this report re-examines the challenge through analysing Finnish data from PISA 2015.

The Finnish school system has consistently excelled among OECD countries and equity has been recognized as its key strengths. However, Finland's performance has failed to keep pace with improvements in other countries. This report examines evidence from PISA 2015 to provide some insights for successful actions in order to slow and eventually reverse the decline in student performance.

The report provides a brief description of the context in which the Finnish system will have to implement strategies to respond to results from PISA 2015. It also examines the performance of students in Swedish speaking schools and Finnish speaking schools to determine the areas of weakness and strength, so as to determine where improvements will result in greater excellence and equity. The analyses are policy and action oriented in order to provide practical suggestions for strategic actions arising from the evidence.

The report is published by the Finnish Institute for Educational Research in collaboration with the Swedish Cultural Foundation in Finland.

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