

Shoresh Research Paper

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Why Israel does poorly in the PISA exams – perceptions versus reality

Noam Gruber*

Abstract

The achievements of Israeli pupils in the PISA 2012 mathematics test place them near the bottom of the developed world rankings. They also indicate large disparities both between Israeli Jews and Arabs, and within these two population groups. Consequently, Israel has the highest gaps in scholastic achievement found in the developed world.

The basic data in Israel actually suggests potential: high parental education levels, high awareness of the importance of math study, and a great willingness to invest money and time in assisting pupils outside of the regular school framework. But low levels of discipline, combined with large classes, compromise the quality of learning in Israeli schools while reducing the ability to attract high-caliber personnel to the teaching profession.

The poor scholastic performance and inequality characterizing Israeli pupils can be attributed to the country's low level of economic development and to large social disparities compared with other developed countries. However, it is reasonable to assume that problems with the Israeli education system are also among the primary factors responsible for this state of affairs. Thus, upgrading the education system is a key policy tool for generating socioeconomic change. To achieve this objective, emphasis should be placed on an area where the Israeli education system is clearly deficient compared with the rest of the developed world: training for attentiveness and discipline. Reducing class sizes, as a secondary measure, may advance the primary goals of improving discipline and attracting quality teachers.

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Why Israel does poorly in the PISA exams – perceptions versus reality

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Introduction

This study compares the performance of Israel's education system with those of other countries, so as to identify problems within the system and their causes. A comparison with developed countries around the world, especially with the ten top scholastic performers, can provide insights as to how the Israeli education system might be improved.

The analysis here is based mainly on data from PISA (Programme for International Student Assessment) 2012. PISA is administered to 15 year olds by the OECD every three years.¹ Of the subjects covered by PISA – mathematics, reading literacy and science – math was chosen as the focus in this study. Beyond its intrinsic importance, math is an international language and is therefore uniquely suited for cross-country comparisons. The PISA math questions are not meant to test specific knowledge – they do not encompass theoretical material, but rather require quantitative thinking.² An education system's success in teaching its pupils quantitative thinking skills is a good indicator of success in teaching skills in other areas. This is borne out by a high correlation between countries' math achievements and their attainments in literacy and science.

Moreover, although math is not the only subject worth studying, it does contribute substantially to labor market achievements, especially in a country as technologically oriented as Israel.³ Mastery of quantitative skills may become even more important in the future, as computers and automation replace less-skilled jobs. As technology becomes ever more sophisticated, the return on innovation and excellence increases. The low level of education currently provided to Israeli pupils clearly places the country at a disadvantage vis-à-vis the challenges of the future.

PISA data

The PISA exams are structured so that for all OECD countries the simple average of the scores is 500, and their standard deviation is 100. Sixty-five countries and half a million pupils participated in PISA 2012. This study focuses on data for the 34 OECD countries (including Israel), as well as Singapore, Hong Kong⁴ and Taiwan, which account for over 300

¹ See the OECD website: <http://www.oecd.org/pisa/aboutpisa>.

² For questions from the PISA exam, see: <http://www.oecd.org/pisa/test> (English), and http://cms.education.gov.il/EducationCMS/Units/Rama/MivchanimBenLeumiym/Quest_Dug.htm (Hebrew).

³ See Kimhi and Horovitz (2015).

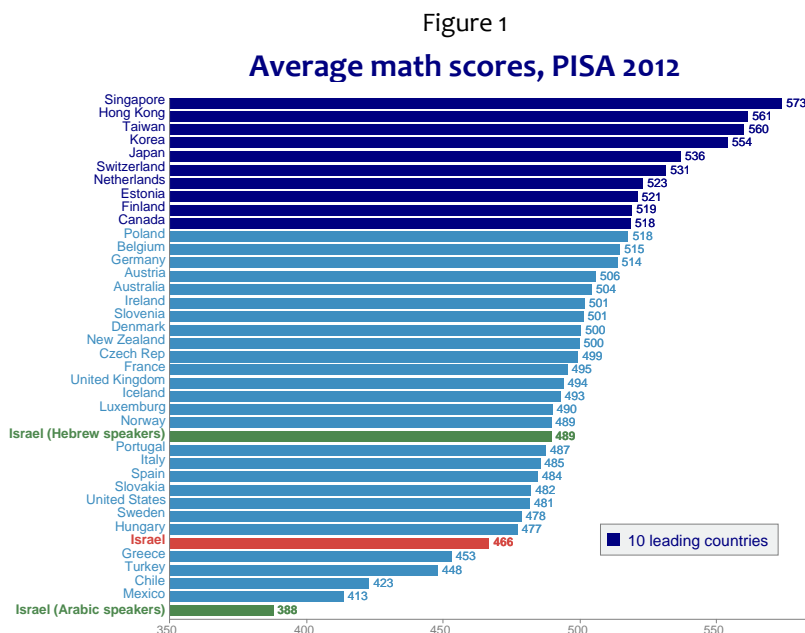
⁴ Hong Kong is not an independent state but rather a special administrative region of China. Because its education system is distinct from the Chinese system, this study treats Hong Kong as separate state.

thousand test-takers. In Israel, 5,055 pupils participated in PISA 2012, representing 172 schools (on average, a random sampling of 30 fifteen year-olds was taken from each school). The exam was administered in Israel in two languages, Hebrew and Arabic; 3,888 pupils took the test in Hebrew and 1,157 in Arabic (for ten exam sheets, no language is indicated in the data).⁵ Haredi (ultra-Orthodox) institutions for boys overwhelmingly refused to take part in the exam, meaning that this sector is under-represented in the data.⁶ In addition to the PISA assessment data, the study makes use of information from other sources, particularly the OECD and the World Bank.

Israel’s overall achievements, and by sector, compared with those of the developed world

In what follows, the 37 countries mentioned above and appearing in Figure 1 will be referred to as “all countries.” Additionally, the ten countries that scored highest in math on PISA 2012 (Singapore, Hong Kong, Taiwan, Korea, Japan, Switzerland, the Netherlands, Estonia, Finland and Canada) are marked in dark blue in Figure 1 and will be referred to as the “leading countries.” In this study, the Israeli education system is compared with the systems of the entire group of 37 countries as well as with systems of the “leading countries”, the ten highest-achieving nations in the world.

As can be seen in Figure 1, the average Israeli pupil score (466) is below most of the comparison countries. Only Greece, Turkey, Chile and Mexico show lower average scores. Also, there is a gap of over 100 points, on average, between the scores of Israel’s Hebrew-language and Arabic-language test-takers. The average score of those who took the test in Arabic (388) is substantially below that of the developed countries, approaching the average scores of developing countries such as Jordan (385). Boys in Israel’s Haredi sector account for 8% of the relevant age group and, for the most part, either do not study math or study it at a low level. Had they participated in PISA 2012, the country’s average



⁵ The exam was administered in Israel by the National Authority for Measurement and Evaluation in Education (RAMA). See: <http://cms.education.gov.il/EducationCMS/Units/Rama/MivchanimBenLeumiyim/OdotPisa.htm>.

⁶ Of 22 Haredi boys’ institutions that were sampled, only three agreed to participate in the exam. All three are identified by RAMA as exceptional – politically, educationally, and in terms of religious ideology – due to the fact that they teach secular subjects. It should be noted that the Haredi girls’ institutions did not mount a similar objection, presumably because those schools do, by and large, teach secular subjects. See: National Authority for Measurement and Evaluation in Education (2013), Chapter 3.

score would likely have been even lower than it already is in Figure 1.

In addition to these low average achievements, Israel's education system exhibits one of the developed world's highest levels of inequality – this despite the fact that Haredi boys, as noted, are not included in the data (Figure 2). By comparison, in 9 of the ten leading countries (the exception is Taiwan), inequality levels are relatively low, in addition to these countries' high achievement levels.

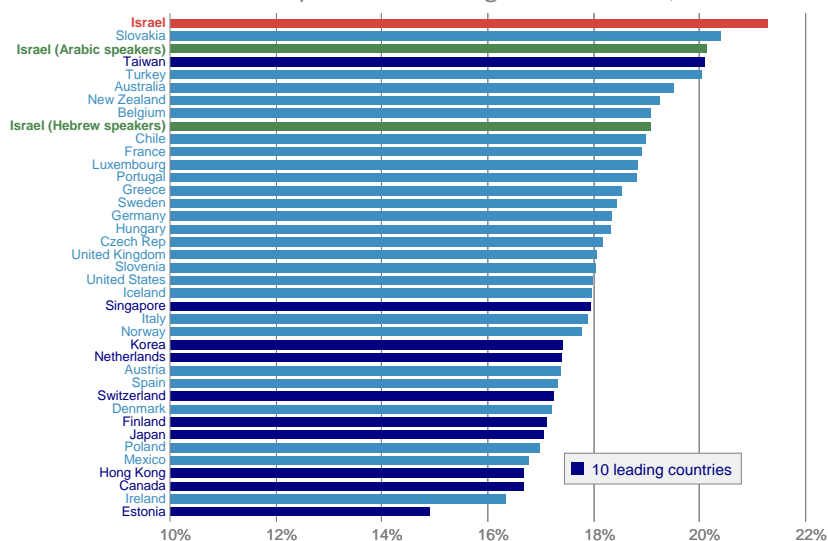
There are two main causes for the high scholastic inequality among Israeli pupils. One is the huge disparity between Jews and Arabs.⁷ The other key determinant is due to the large gaps that exist within these groups, as indicated in Figure 2. Figure 3 displays the average math score by decile. It is possible to see that the scores of Israeli pupils are lower than the all-country average across the distribution. Also graphically evident are the large disparities between the average scores of Jewish and Arab pupils. Since there are relatively more Arabs in the lower deciles, the slope of the curve (representing gaps between deciles) for all Israeli pupils is greater than the slopes of the individual curves for Jewish and Arab pupils.⁸

One might assume that Israel's low scores can be attributed solely to the weaker segments of society, and that the People of the Book's higher-achieving pupils measure up to their counterparts elsewhere in the world. But that would be incorrect. When the focus shifts to the highest scholastic percentiles (Figure

Figure 2

Educational inequality

Standard deviation as percent of average score in math, PISA 2012

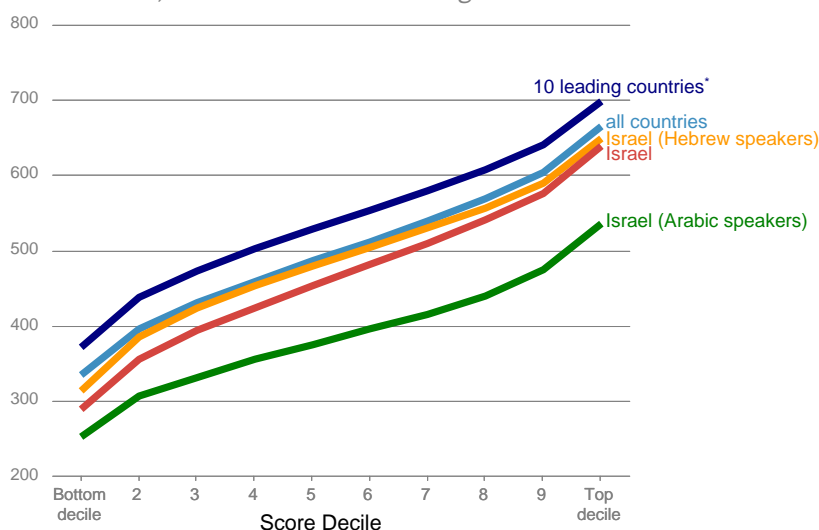


Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 3

Math average, by score deciles

Israel, all countries and 10 leading countries*



* 10 leading countries: Canada, Estonia, Finland, Hong Kong, Japan, Korea, Netherlands, Singapore, Switzerland, Taiwan.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

⁷ For simplicity's sake, this study sometimes refer to pupils who took the PISA exam in Arabic as Arabs, and to pupils who took the exam in Hebrew as Jews.

⁸ As can be seen in Figure 36, the weight of Arab pupils in the lowest decile for all Israeli pupils is more than half, while their weight in the highest decile is one percent.

4) there is no evidence of a narrowing of the gap. In fact, the gap widens. For example, the difference in scores between the 91st percentile of Israel's Hebrew-language test-takers and the 91st percentile of all countries is 13 points while in the top percentile, there is a 39 point gap. The disparity between Israel's Arabic education system and the average for all countries also widens in the highest percentiles, from a difference of 126 points in the 91st percentile to one of 139 points in the top percentile.

On average, boys do better than girls in the PISA math test (Table 1). This is true for the ten leading countries average, for the all-country average, and for Israel. Within Israel however, while boys have the advantage among Hebrew speakers, the opposite is true of Arabic speakers, among whom girls do better. Accordingly, the disparity between the Hebrew and Arabic test-takers differ by gender: among boys there is a gap of 113 points while among girls it declines to 88 points.

The findings point to substantial inequality in math achievement, both between the different groups in Israeli society and between Israel and the developed world. This combination of low achievements and high inequality has long characterized the Israeli education system. As shown by Ben-David (2014), on all of the TIMSS (Trends in International Mathematics and Science Study, administered to fourth and eighth graders)

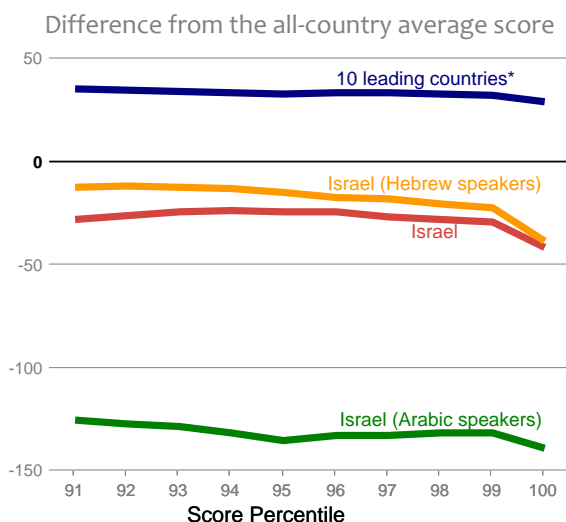
and PISA assessments since 1999, Israel has exhibited the highest level of inequality in achievements among the developed countries. Moreover, on all but the TIMSS 2011 exam, the average performance of Israeli pupils was very low.⁹ This state of affairs is also reflected in the labor market, as Israel's labor productivity is below of most developed countries (Ben-David, 2013), while Israeli wage gaps are among the largest in the developed world (Kimhi and Shraberman, 2014).

High-quality and inclusive education is crucial for a strong and healthy society. Israeli pupils' low attainments, and the large gaps between them, testify to failures of the education system. The questions that need to be asked are: What are the reasons for these failures; and, what policy measures should be taken to remedy them? To answer these questions, it is necessary to examine the various factors affecting scholastic performance, beyond the curriculum itself. These factors can be divided into three main areas:

⁹ See Ben-David (2010) and Ben-David (2011).

Figure 4

Math scores in top 10 score percentiles



* 10 leading countries: Canada, Estonia, Finland, Hong Kong, Japan, Korea, Netherlands, Singapore, Switzerland, Taiwan.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Table 1

Mathematics scores by gender

	10 leaders	all countries	Israel	Hebrew	Arabic
boys	535	494	461	481	393
girls	544	505	472	496	383
difference	-9	-11	-12	-15	10

* rounded numbers.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

- Family background, which is indicative of the educational-social background that a child brings to the school system and of his parents' ability to help with the child's studies.¹⁰
- Enrichment activity that takes place outside of the education system.
- The learning experience within the education system.

This study surveys the aforementioned areas, focusing on their impact on Israeli pupils' achievements.

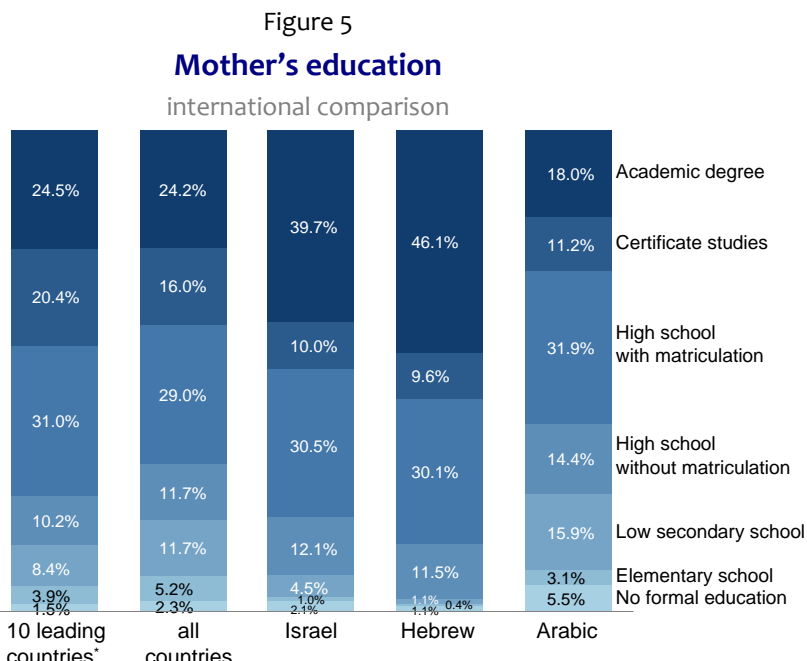
Family background

Pupils do not enter the education system as blank slates. The importance that parents attach to schooling and education, their ability and willingness to assist their children with their studies (whether directly, by helping them with their homework, or indirectly by hiring private tutors) and the degree of their insistence on holding them to target standards of scholastic performance, all contribute substantially to their achievements. Thus, a pupil from a home that values education has a higher likelihood of scholastic success even if the quality of instruction available at his school is not particularly high, and vice versa – a pupil from a home that does not attach as much importance to studying may perform poorly, even if his teachers are good and willing to help. The PISA 2012 questionnaire contains questions about the parental education levels and on the degree of importance that the pupil and his parents attach to math study.

Parental education level

Parental education is considered to be a strong factor in determining pupil achievement. Studies have shown that maternal education has a particularly strong impact.¹¹ Figure 5 displays the distribution of pupils' maternal education levels, as reported by PISA.¹²

Compared with other nations, Israel has a high share of well-educated mothers. This is due to the non-Haredi Jewish population's relatively high percentage of such mothers. It should be noted that the quality of educational institutions and study tracks may differ from country to country in a way that is hard to quantify. Also, in many countries it is common to pursue post-secondary vocational (non-academic)



* 10 leading countries: Canada, Estonia, Finland, Hong Kong, Japan, Korea, Netherlands, Singapore, Switzerland, Taiwan.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

¹⁰ Throughout this study, no importance is to be attached to the gender chosen in the text.

¹¹ See Currie and Moretti (2003). The regression results in Table B2 of Appendix B also show a stronger impact for maternal education.

¹² PISA data on parental education level are based on the UNESCO ISCED standard. See Appendix A.

studies. This is reflected in a high percentage of mothers in the rest of the developed world, and especially in the ten leading countries, whose education level is listed as “certificate studies.” To account for this, Figure 6 places all mothers with a post-secondary education – academic or non-academic – in the same category.

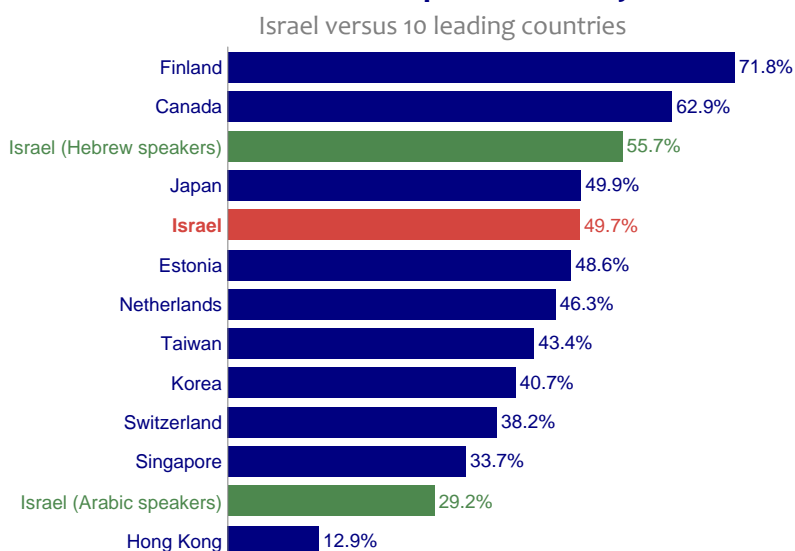
Even when taking into consideration the prevalence of post-secondary vocational study in some of the ten leading countries, the share of Jewish mothers with post-secondary education is relatively high – below only that of Finland and Canada. The mothers of Arab Israeli pupils have relatively low rates of education, though they are higher than those of Hong Kong and not far from those of Singapore.

In light of the relatively high level of maternal education in Israel, it would appear that parental education is not a leading cause of the pupils’ low scores. But can the gap between Jewish and Arab pupils be attributed solely to disparities in parental educational? Figure 7 shows that this explanation is far from adequate, as the average-score disparity between Jewish and Arab pupils whose mothers have academic degrees – 99 points – is similar to the overall gap of 101 points between the groups (i.e. without taking maternal education into account). In fact, as indicated in the figure, the gap between Jewish and Arab pupils’ achievements is particularly large among the most educated mothers.

A comparison of pupil attainment by maternal education level indicates that, among Israeli Jewish pupils, the advantage enjoyed by those whose mothers hold academic degrees is particularly great. Figure 8 looks at the percent differences between Israeli scores and average all-countries scores at each maternal education level. While gaps between Israeli pupils and the all-country average score exist at all maternal education levels, they

Figure 6

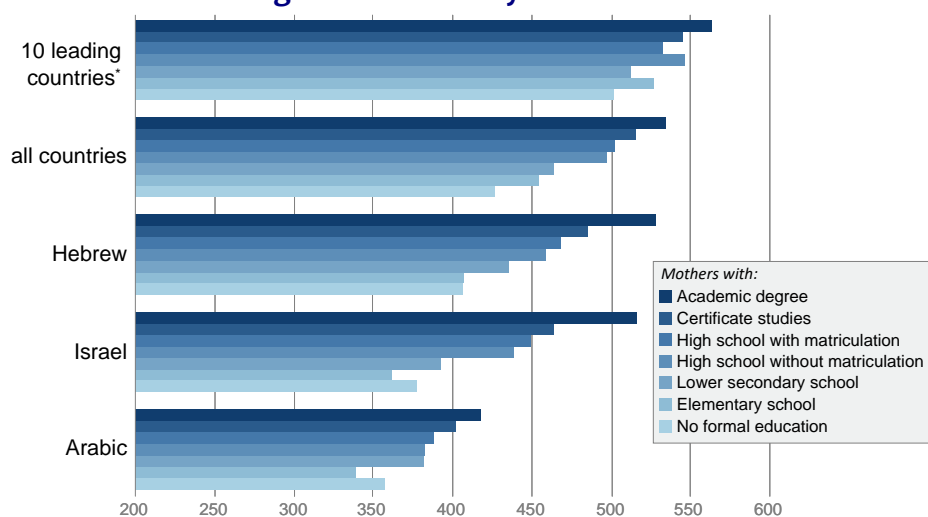
Share of mothers with post-secondary education



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 7

Average math scores by mother’s education



* 10 leading countries: Canada, Estonia, Finland, Hong Kong, Japan, Korea, Netherlands, Singapore, Switzerland, Taiwan.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

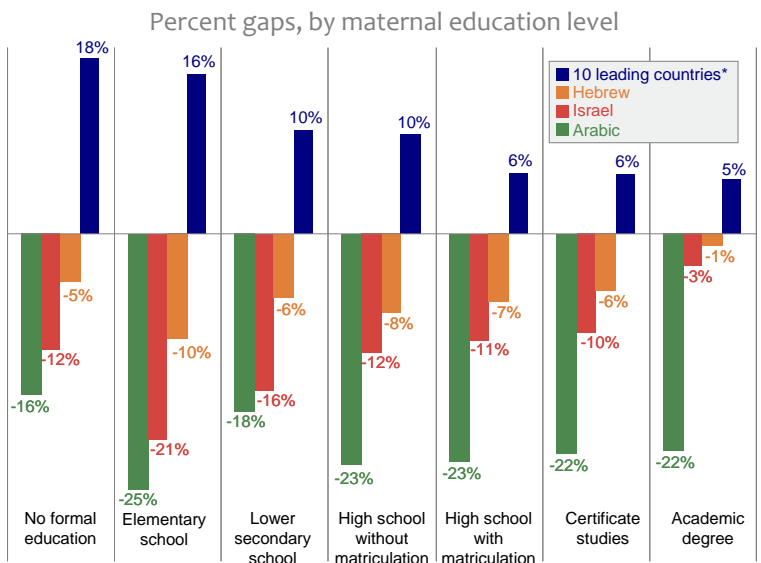
are particularly large at the lower levels, ranging from 12 to 21 percentage points. The gap between Israel and the all-country average falls to just 3% among children of mothers with academic backgrounds.

When Jewish and Arab pupils are compared, the disparities exist at all maternal education levels, though they widen as maternal education levels rise. The gap between the scores of Jewish and Arab pupils whose mothers are less-educated, as a percentage of the mean score for all countries at that education level, ranges from 11% to 15% (50-70 points). For children whose mothers have an academic education, the gap between their children widens to 21% (110 points).¹³ It appears that Arab pupils with academically educated mothers do not enjoy the same advantage over their peers that their Jewish counterparts do. Additionally, Figure 8 shows that the gap between the average for the ten leading countries and the all-country average is particularly large at the lower levels of maternal education, and falls at the higher maternal education levels – suggesting that the education systems of the ten leading countries are relatively more equitable.

Figure 9 shows the average difference in pupil achievements by maternal education level relative to pupils whose mothers hold matriculation certificates. The gaps between the children of highly-educated and less-educated mothers are relatively small in the ten leading countries. Pupils whose mothers have no education attained scores only 6% lower than those of pupils whose mothers have matriculation certificates, which in turn are just 6% lower than the scores attained by pupils whose mothers are academically educated. The education systems in these countries succeed in bringing children from lower socioeconomic strata to achievements

¹³ For the exact disparities, see Figure C1 in Appendix C.

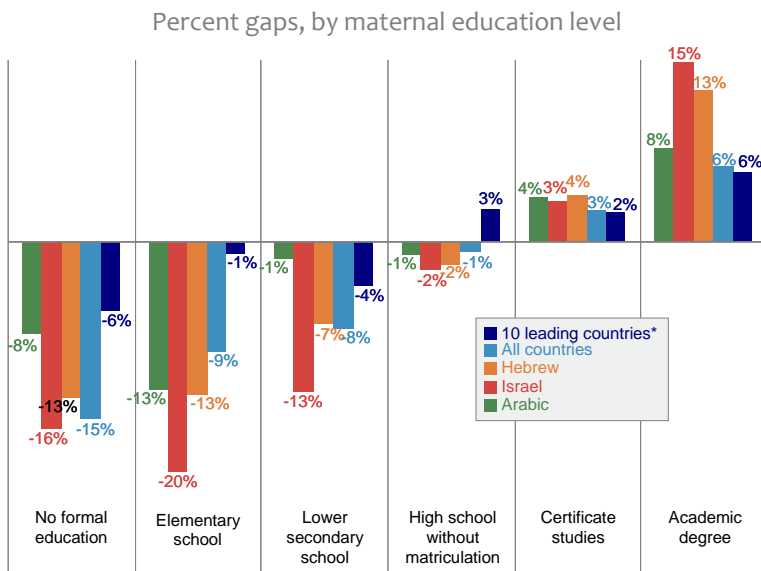
Figure 8
Differences from the all-country average score



* 10 leading countries: Canada, Estonia, Finland, Hong Kong, Japan, Korea, Netherlands, Singapore, Switzerland, Taiwan.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 9
Gaps in scores from pupils whose mother graduated with high school matriculation



* 10 leading countries: Canada, Estonia, Finland, Hong Kong, Japan, Korea, Netherlands, Singapore, Switzerland, Taiwan.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

not much lower than those of children from highly-educated and affluent families. In other words, these countries' education systems are relatively equitable, fostering greater social mobility.

There is a much greater correlation between pupil achievements and parental education levels in Israel, meaning that the education system is less successful than those in leading countries in advancing children from less-affluent homes. Thus, the Israeli gap between the achievements of pupils whose mothers are not educated and pupils whose mothers have matriculation certificates is 16%, while the disparity between the latter group and those whose mothers hold academic degrees is 15%.

Furthermore, even pupils from highly-educated households do not attain particularly high scores. The average performance of a pupil in Israel's Hebrew education system whose mother has an academic background is lower than that of the average pupil in the ten leading countries whose mother has only 12 years of schooling, and is comparable to the performance of the average pupil whose mother has only primary-level education in those countries.

The situation in Israel's Arabic education system is far worse. Average achievement levels of pupils whose mothers have academic educations is less than the average attainments of a pupil in the Hebrew education system whose mother has only lower secondary education. Once again, the conclusion is that even (and especially) when taking into consideration the parental generation's education level, Israel's education system is characterized both by large disparities and by low achievements compared to the education systems of the world leaders.

Indirect impact of parental education level

Beyond the direct impact that parents' education levels have on their children, they may also have an indirect effect on the learning environment: the higher the percentage of parents with academic degrees in a class, the better the pupils' performance. This effect is likely the outcome of two main factors: First, it is reasonable to assume that the learning atmosphere will be more positive as the percentage of pupils from highly-educated families in a class rises. Second, a high percentage of well-educated parents is generally accompanied by a strong socioeconomic environment, in which schools have more abundant resources, are able to attract and retain better teachers, and build and maintain higher-quality infrastructures. Thus, whatever his parents' education level, a pupil's scholastic success tends to increase as the education level of his classmates' parents rises.

Table 2 shows the distribution of pupils in classrooms by class rate of parental post-secondary education (both academic and non-academic). The percentage of Israeli pupils in classes where over 75% of the parents have post-secondary education is 13%, much higher than the rate for all countries (6%) or for the ten leading countries (8%). However, when the Israeli figures are broken down into Hebrew and

Table 2
Distribution of pupils by type of class
classes differentiated by percent of
parents with post-secondary education

	10 leaders	all countries	Israel	Hebrew	Arabic
up to 25%	18%	28%	13%	4%	42%
25%-50%	40%	40%	37%	34%	49%
50%-75%	34%	26%	36%	45%	9%
above 75%	8%	6%	13%	17%	0%

* rounded numbers.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Arabic speaking education systems, the disparities are clear: in the Arabic system there is a negligible number of classes with at least 75% pupils' parents having a post-secondary education. 42% of pupils are in classes where less than a quarter of the parents have post-secondary education. This contrasts with just 4% of pupils in Hebrew-speaking classes where less than a quarter of the parents have post-secondary education.

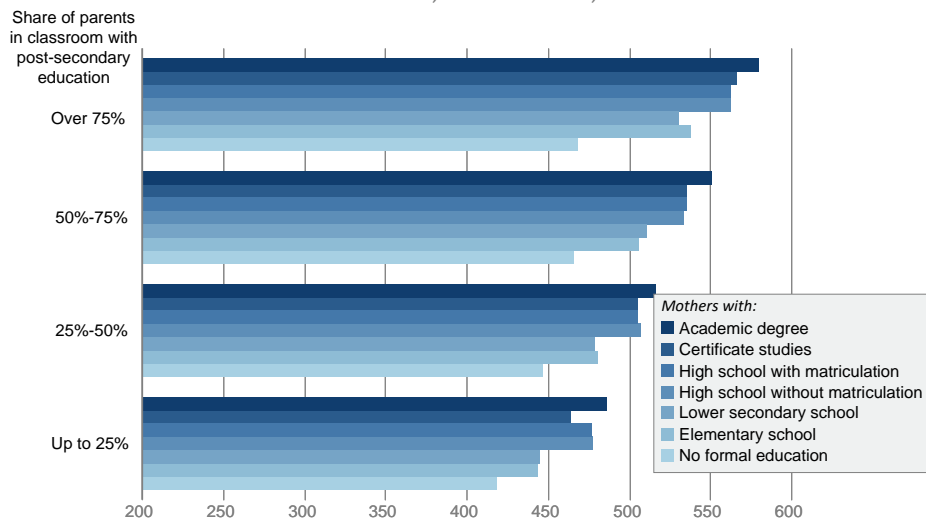
To distinguish between the impact of maternal education and that of the overall average education of parents in a class,

Figure 10 looks at the achievements of pupils by maternal education level, broken down into different class parental education levels. Pupils whose mothers have identical education levels do better scholastically as the average class education level rises. Thus, when pupils from lower socioeconomic strata are included in classes with pupils from highly educated homes, their achievements tend to improve. This argument also works in the opposite direction: a high percentage of pupils whose average parental education levels are relatively low, may have a significant adverse effect on the achievements of pupils more educated parents. The topic of classroom peer effect has been extensively studied by economists.¹⁴

In light of the above, what portion of the attainment gap between Jewish and Arab pupils with similarly-educated mothers can be explained by the parental education level of their classmates? Figures 11 and 12 show the achievements of Israeli Jewish and Arab pupils by maternal education level and by class parental education level.

Figure 10
Student scores by mother's education and average education level of classroom parents

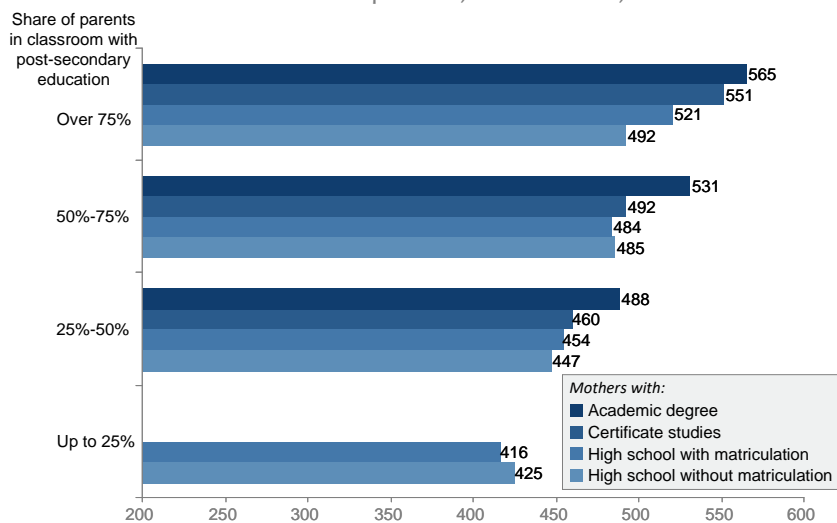
All countries, mathematics, PISA 2012



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 11
Student scores by mother's education and average education level of classroom parents

Israel – Hebrew speakers, mathematics, PISA 2012



* Categories where there are less than 20 pupils are omitted (missing bars).

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

¹⁴ For a review of the topic, see Sacerdote (2011).

Hebrew-language test-takers clearly show the positive impact of a rise in average parental education level (Figure 11), from the lowest to the highest categories. By contrast, among those who tested in Arabic (Figure 12), the difference in pupil performance between classes where no more than a fourth of the parents have post-secondary education and classes where one fourth to one half of the parents have post-secondary education is negligible. A positive effect is discernible only in classes where more than half of the parents have post-secondary education.

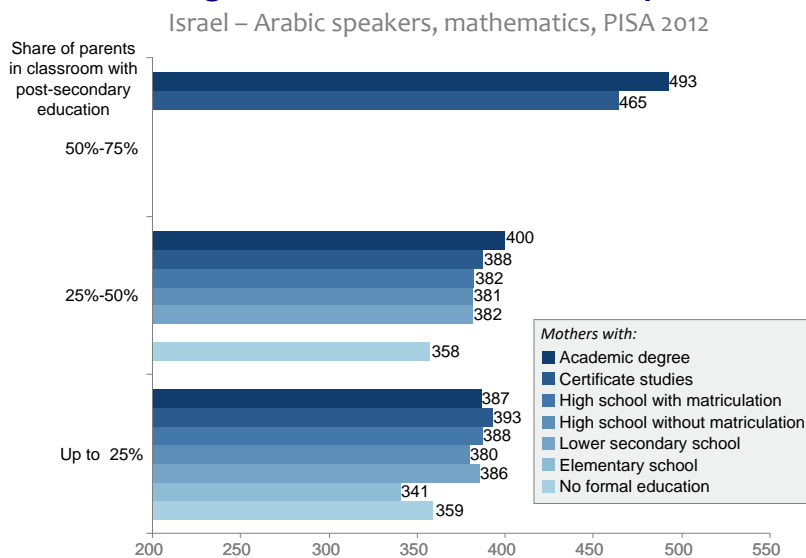
It is hard to compare the achievements of Jewish and Arab pupils by classroom parental education level, as the percentage of pupils in the Arab sector who study in classes where 75% or more of the parents have post-secondary education is practically nil (Table 2), while the percentage of parents with less than 12 years of schooling in the Jewish sector is very low (for the percentage of mothers, see Figure 5). Nevertheless, it is possible to conclude that a classroom's average parental education level is responsible for a major portion of the gap between Jewish and Arab pupils whose parents have similar educational backgrounds. For example, the disparity between an Arab pupil studying in a class where 50 to 75% of the parents have post-secondary education, and whose own parents have post-secondary education (493 and 465 on average for a pupil whose mother has an academic degree or completed certificate studies, respectively), and a Jewish pupil in a classroom of similar attributes (531 and 492 on average for a pupil whose mother has an academic degree or completed certificate studies, respectively) declines to 30-40 points, versus a gap of 80-100 points between pupils whose parents are similarly educated, without taking classroom composition into account (see Figure 7).

Family awareness of the importance of mathematics

As discussed above, the high education level of Israel's current generation of parents has not translated into high achievement among their children. Beyond parental education, familial awareness of the importance of math study plays an important role in pupil motivation and effort. Is Israel, the *Start-Up Nation*, lacking in awareness of the importance of math?

As Figure 13 shows, that is not the case. The percentage of Israeli pupils, Jews and Arabs, who feel that their parents attach importance to math study is the highest in the developed world. Figure 14 reflects the fact that Israeli pupils, like their parents, are well aware of the importance of math study for their occupational future, and they lead the developed world in this regard.

Figure 12
Student scores by mother's education and average education level of classroom parents



* Categories where there are less than 20 pupils are omitted (missing bars).

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research

Data: PISA 2012

The importance that pupils and their parents attach to math study appears to be related to the fact that math study is a differentiating factor: in Israel, as shown by Kimhi and Horovitz (2015), relatively few pupils study math at higher levels, but those who do so enjoy an advantage in terms of admissions to universities in general, and to more prestigious study tracks in particular. By contrast, in countries with high levels of math education (Japan, Taiwan, etc.), many pupils do well in math. As a result, math has ceased to be a major differentiating factor in these countries.

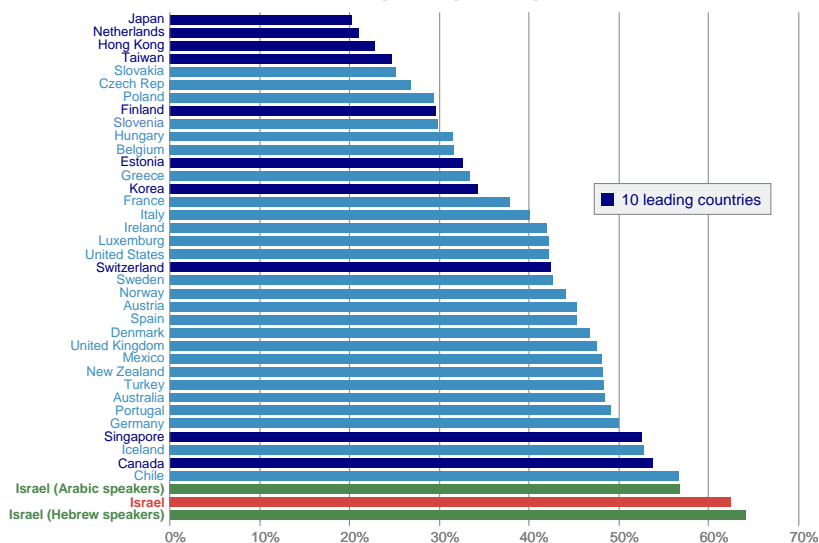
Study outside of the school framework

The previous section clearly demonstrated the importance that Israeli parents and pupils attach to math study, which also manifests itself into action. Math enrichment activity, which generally entails substantial costs in terms of money and/or time, attests to the importance that pupils and their parents actually attach to the acquisition of math skills.

Figure 15 presents the number of weekly math enrichment hours reported by pupils in the various countries.¹⁵ Israel ranks near the top in this ranking as well. Particularly exceptional in this regard are Israel's Arab pupils, whose reported weekly number of math enrichment hours is greater than those in all of the

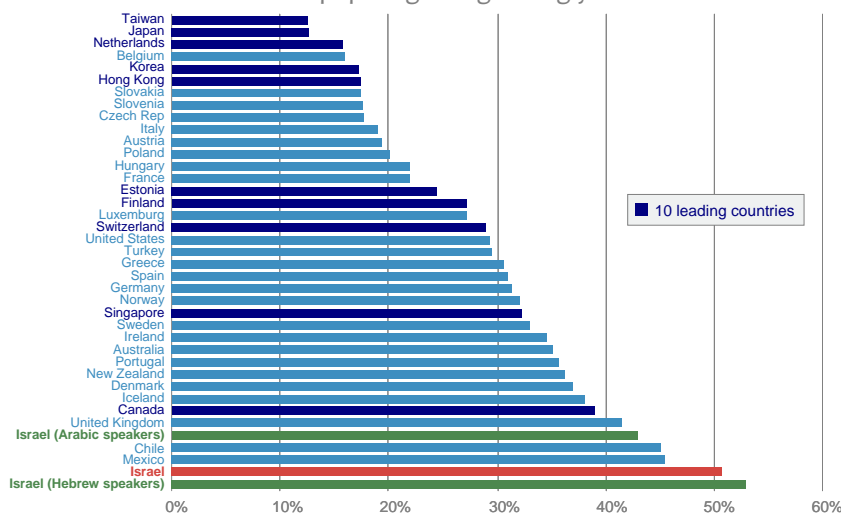
¹⁵ Author's calculation. In the PISA questionnaire, the possible answers to the question "how many hours do you typically spend per week attending in the following subjects?" are "I do not attend in this subject" (computed as 0 hours), "Less than 2 hours a week" (computed as one hour), "2 or more but less than 4 hours a week" (computed as 3 hours), "4 or more but less than 6 hours a week" (computed as 5 hours), and "6 or more hours a week" (computed as 7 hours).

Figure 13
"my parents believe it's important for me to study mathematics"
 Share of pupils agreeing strongly to statement



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
 Data: PISA 2012

Figure 14
"learning mathematics is worthwhile for me because it will improve my career prospects"
 Share of pupils agreeing strongly to statement



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
 Data: PISA 2012

countries except Korea and Singapore. Jewish pupils also benefit from a relatively high number of enrichment hours, more than do pupils in many countries whose achievements are significantly higher (including 6 of the ten leading countries: Finland, Hong Kong, Estonia, Canada, the Netherlands and Switzerland).

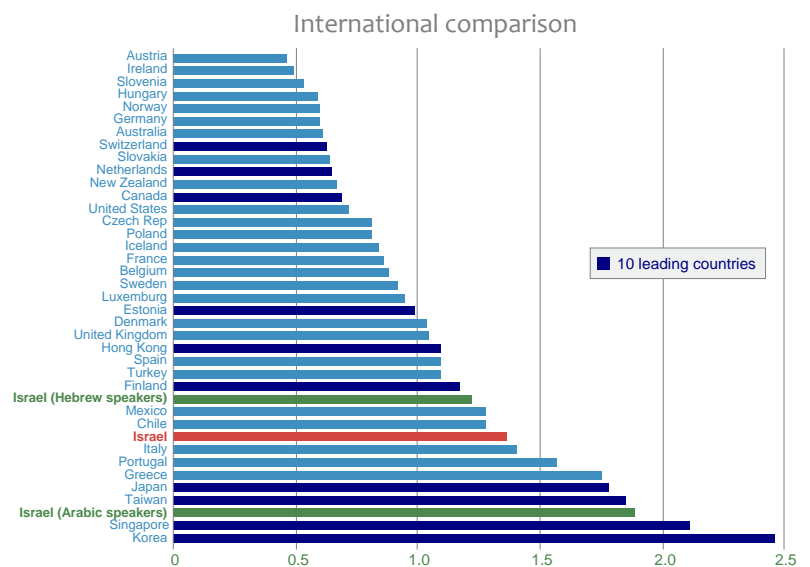
As Figure 16 shows, children of mothers whose education level is low, and whose income is presumably lower than average, receive no fewer enrichment hours, and sometimes substantially more, than do the children of highly-educated mothers.

Differing approaches to math enrichment – strengthening weaker pupils or nurturing excellence

Pupil and parental decisions regarding the need for enrichment are influenced both by the formal education system’s performance and by social norms. It stands to reason that when the level of math knowledge provided by the school is considered sufficient, the parental desire for enrichment lessons for their children should decline. Only when they believe that the education system does not provide sufficient skills will parents be inclined to seek external enrichment for their children.

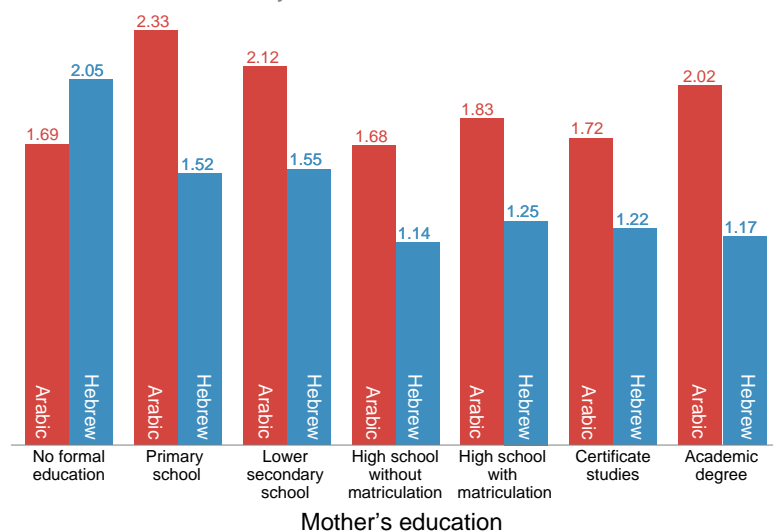
However, in countries where the schools provide quality education, but there is intense competition for the limited number of spaces at prestigious universities and desirable workplaces, pupils may also turn to external enrichment in order to gain an advantage over their peers. As Figure 17 shows, in Israel, as in five of the Western nations represented among the leading countries, the average score declines as the number of enrichment lessons pupils receive per week grows. This provides support for the conjecture that enrichment activities constitute a supplemental educational tool and a means of closing gaps for low-achieving pupils. In three of the countries – Taiwan, Japan and Korea – however, there appears to be an increased tendency to reinforce pupils who are already scholastically strong,

Figure 15
Weekly math enrichment hours



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 16
Weekly math enrichment hours
By mother’s education



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

that is, to nurture mathematical excellence. Singapore and Hong Kong exhibit a mix of the two approaches.

Education system performance

Of the three key components affecting pupil achievements in math – parental education, enrichment activity outside of the school framework, and the learning experience within the education system – the first two indicate that Israeli pupils have an advantage over their peers in other countries. Israeli parental education levels, especially for Jewish pupils, are high relative to those in other developed countries. Arab parental education levels are relatively low, but are not vastly different from the developed-world average. Moreover, both parents and pupils in Israel – Jews and Arabs alike – attach greater importance to math study than do their counterparts in the developed world. This perceived importance also translates into actual investment, with Israeli pupils receiving a relatively large number of enrichment hours, presumably at a cost to their parents.

Yet despite these advantages, Israeli pupils’ achievements are low relative to the developed world. The explanation for this poor performance may therefore lie in the learning experience provided by the country’s education system, which does not enable pupils to benefit from these advantages and succeed in math. There is a question of whether the problem is quantitative, i.e., a shortage of study hours, or qualitative – an inferior learning experience. The answer to this question is important: if all that is required are additional study hours, then the way to improve pupil math performance is simple and clear. If, however, the problem is primarily qualitative, then the solution is not larger budgets or “more of the same.” Rather, it requires a rethinking of the education system’s approach, and a fundamental change to this system.

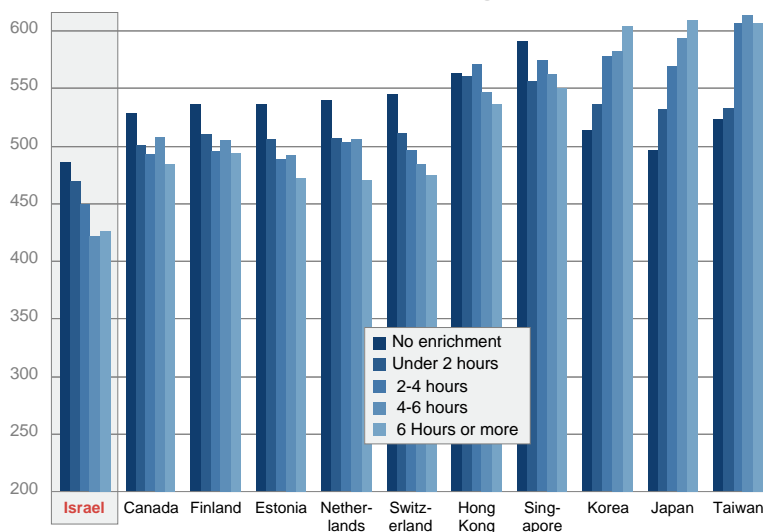
The amount of time devoted to math instruction

The first question to ask is whether enough time is being devoted to math instruction. On the PISA questionnaire, pupils state the number of minutes per week that are spent in math class. As Figure 18 shows, Israel ranks fairly high internationally in terms of the number of minutes of math instruction that it provides to its pupils each week. Although Jewish pupils enjoy half an hour of math instruction more per week than do Arab pupils, the number of hours received by the latter is still above the developed country median.

However, the fact that the Israeli school week is six days, rather than five as in most of the other countries, may skew the result (if the number of weeks of study is lower in Israel), meaning that Israel’s large number of weekly minutes does not necessarily indicate a large number of yearly hours. Figure C1 in Appendix C presents a computation of annual

Figure 17

Average score by weekly math enrichment hours
Israel versus the 10 leading countries



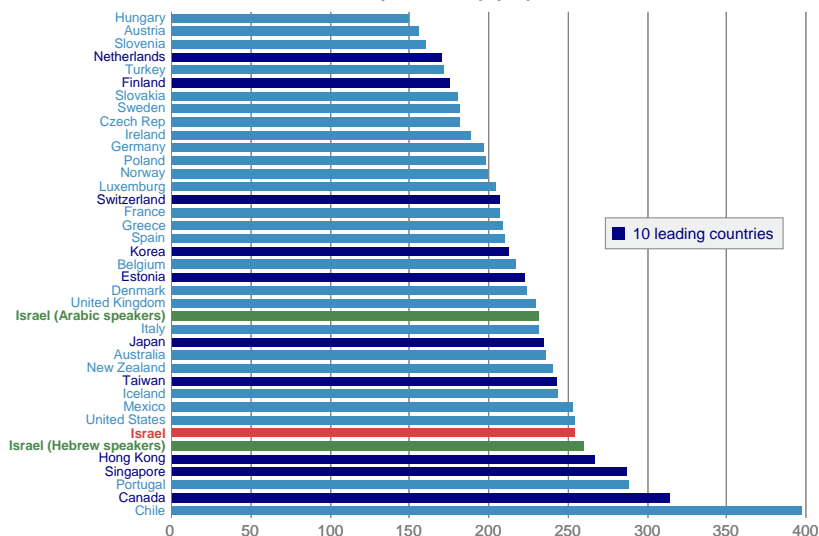
Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

math lesson hours per OECD data. We see that even in terms of these figures Israeli pupils receive a relatively large number of math instructional hours annually.¹⁶ Figure 18 shows that there is no clear correlation between amount of time devoted to study, and achievements: there are countries with low achievements, such as Chile, Mexico and Israel, that devote many hours to math instruction, while some countries with high achievements, such as Finland, the Netherlands, Estonia, Korea and Japan, devote relatively little time to math instruction.¹⁷

Pupils in Israel's Hebrew language system receive a relatively large number of math instruction hours per year, while Arab pupils, who receive fewer hours than their Jewish peers, still receive more hours, on average, than their counterparts in the developed countries. As Figure 19 shows, given a specific number of weekly lessons,¹⁸ the score disparity between Jewish and Arab pupils persists, that is, the Jewish-Arab gap in the number of hours devoted to math instruction does not fully explain the score gaps. Jewish pupils who receive a relatively high number of lessons (4-7) approach the average achievements for all countries, but still lag behind the ten leading countries.

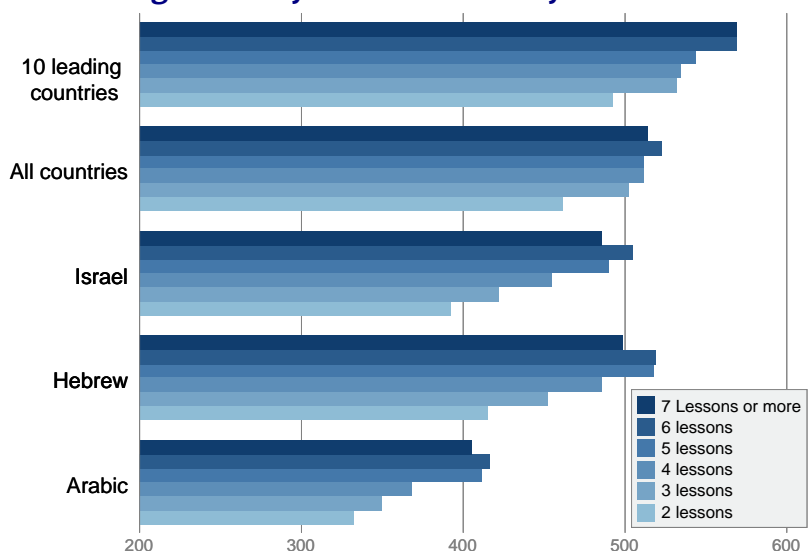
Figure 19 reflects huge disparities in the efficacy of instruction between Israel's various education

Figure 18
Minutes of weekly math school study
reported by pupils



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 19
Average score by number of weekly math lessons*



* 45 minutes per lesson.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

¹⁶ It should be noted that this is a total math study time period. The Israeli school year structure, which is characterized by long school weeks, but relatively long vacations, may affect instructional efficacy relative to other countries.

¹⁷ This has also been noted in the relevant research literature. Baker et al., 2004. Hanushek (2003) and Lavy (2010) find that the impact of number of study hours is closely related to the quality of instruction. It should also be noted that in some of the comparison countries, pupils receive many math enrichment hours outside of the formal educational framework; see Figure 15.

¹⁸ The number of weekly lessons is calculated in terms of 45 minutes per lesson.

systems – the achievements of Jewish pupils who receive two math lessons per week are identical to those of Arab pupils who receive 6 lessons. Yet the Hebrew language education system itself has little to be proud of: in the ten leading countries a pupil who receives 3 weekly math lessons reaches higher attainments than does an Israeli Jewish pupil who receives any number of weekly lessons.

The lack of a relationship between a country's number of math instruction hours and its average PISA results, alongside the fact that an average Israeli pupil receives many instructional hours but has poor achievements, indicate that the Israeli education system mistakenly focuses on instructional quantity rather than on quality.

Instructional quality

Because gaps in the number of study hours do not explain the disparities between Israel and the developed countries, or within Israeli society, the remaining explanatory factor is the quality of instruction. This study focuses on three components of learning-experience quality:

- Class size, which affects the amount of attention that each pupil receives from the teacher.
- Discipline level, which affects the teacher's ability to make use of lesson time for effective, in-depth teaching.
- Teacher quality, which directly affects instructional quality.

These components have reciprocal effects. For example, high-quality teachers can elicit higher levels of attentiveness and discipline. At the same time, healthy norms for attentiveness and discipline can attract higher-quality manpower to the teaching profession and help retain it. Alternatively, the difficulty of coping daily with discipline problems can deter quality personnel. Small classes may help improve discipline levels and attract quality teachers, while high discipline levels make it possible to teach larger classes effectively. This study does not focus on the education system's organizational structure, despite its great importance to the system's incentive structure and to effective utilization of education resources, since – in the author's opinion, at least – the PISA 2012 data are insufficient to illuminate this issue in a meaningful way.

Class size

It is commonly thought that large classes compromise instructional quality. This topic tends to draw considerable public attention – exemplified in Israel by the “sardine protest” – due to (a) the ease with which class size is measured, and (b) the simple logic underlying the idea that the number of pupils in a class affects the quality of instruction. In Israel, there exists a negative correlation between class size and math achievements, with pupils in large classes averaging higher scores (Figure 20).¹⁹ But smaller classes are often special education classes, or located in economically disadvantaged localities, while the more established localities generally have large classes.²⁰ Thus, because stronger pupils are placed

¹⁹ The classes here are homeroom classes, not math classes, for which data are not available.

²⁰ At the primary school level this is formally anchored in the school's Strauss Nurture Index. On the Education Ministry's affirmative action policy and its actual implementation, see Blass, *The Education System – an Internal Perspective* (2010).

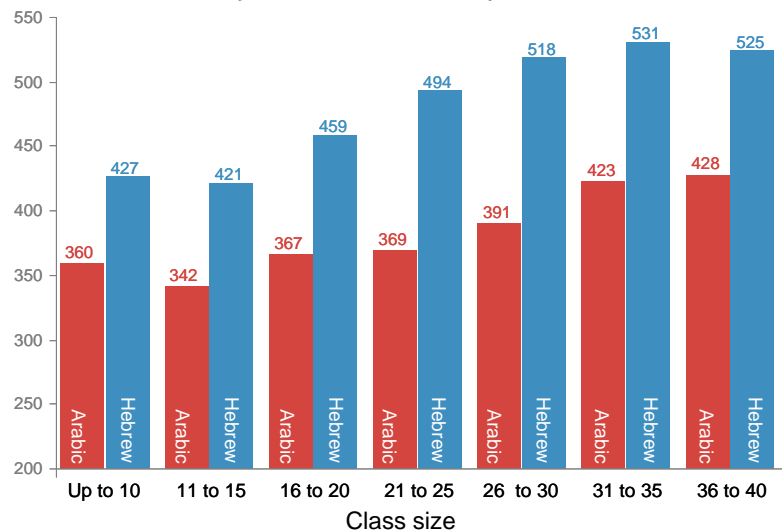
in large classes, their achievements are higher than those of pupils in small classes, creating the incorrect impression that studying in large classes improves achievements.

Due to this problem, research on the topic has focused on assessing the impact of class size while taking into consideration possible differences in the composition of large and small classes. Some studies have found that small classes have an advantage²¹ while other studies have argued that class size is of no importance.²² In the final analysis, class size does seem to have an impact on the quality of learning, but that impact is highly dependent on other factors, especially pupil attention and discipline levels. Theoretical research in this area posits that the negative impact of disciplinary problems worsens as class size increases (Lazear 2001). The findings discussed below provide empirical support for this theoretical hypothesis.

Within the developed world, Israel ranks near the top of the list for average number of pupils per class (Figure C2 in Appendix C). This clearly impairs teachers' ability to provide individual attention to pupils who need it, and it intensifies the negative impact of disciplinary problems on pupils' achievements.

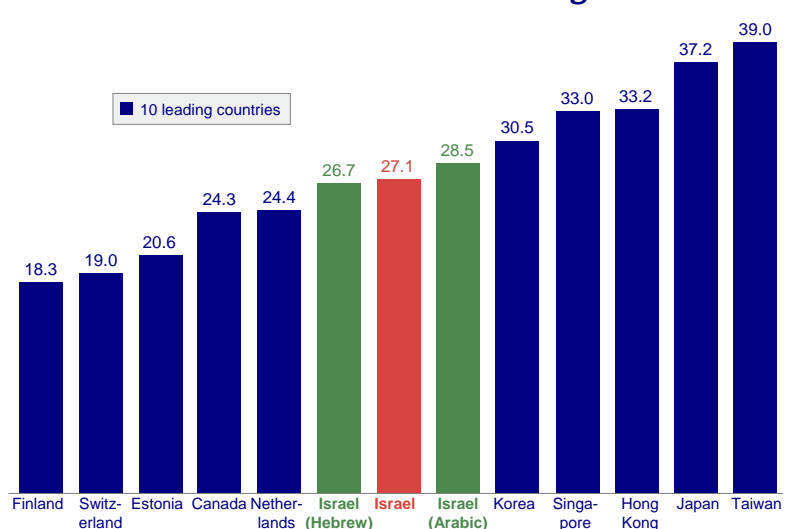
Nevertheless, it should be noted that among the countries leading the world in pupil performance, there are several in which the average number of pupils per class is much larger than in Israel. As Figure 21 shows, there are geographic and cultural distinctions that delineate between countries when it comes to this issue. Among the ten leading countries, the five located in East Asia have large classes while the five Western countries have small classes, with Israel situated in the middle of the two groups.

Figure 20
Average scores by class size in Israel
by Hebrew and Arabic speakers



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 21
Class size in Israel and in the 10 leading countries



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

²¹ See Angrist and Lavy (1999). This article uses Israel's 40-pupil class size limit to compare the achievements of pupils in large classes with those of pupils with similar profiles in cases where this size limit forces schools to create smaller classes. The article finds a small but statistically significant advantage for small-class learning.

²² See Hoxby (2000).

The reason for this distinction between the two halves of the ten leading countries is not Europe's low birth rate since the East Asian group also has downward trending birthrates. This is particularly true of Japan, where the population has been contracting for many years. It is also evident that, because these are affluent countries that attach considerable importance to education, they would have been able to reduce the number of pupils per class had they so wished. The two distinct models represent different choices: the East Asian model features large classes that presuppose a high level of order and discipline, while the Western model features small classes with a correspondingly greater emphasis on creativity and self-expression. While Israel falls between these two groups – between East and West – in terms of the number of pupils per class, where does it stand in relation to these countries in terms of discipline?

Attentiveness and discipline

Attentiveness and discipline are characterized by a number of dimensions, including pupils' ability to listen and concentrate for lengthy periods of time; their ability to keep quiet, thereby facilitating concentration and a positive learning atmosphere for their classmates; and their self-discipline, which translates into diligence and studiousness. As shall be seen below, attentiveness and discipline rise in importance as explanatory factors for achievements when classes grow in size and the number of potential disturbances increases. Beyond simple intuitiveness, the importance of discipline to the classroom learning experience has a solid basis in research, both theoretical and empirical.²³

Stricter discipline does not always translate into better outcomes; excessive strictness can lead to over-conformity and suppress creativity. While high disciplinary levels foster quality learning in large classes, lower levels of discipline require smaller classes and more individual attention to pupils, with the attendant repercussions regarding pupils' ability to develop self-discipline. Attentiveness and discipline make the teacher's job easier – more rewarding, with less attrition – in turn, affecting the population segment attracted to the teaching profession and that remaining in it.

What is the level of discipline in the Israel education system? Given the relatively large size of Israeli classes, this is not an idle question. The next section looks at the issue from the pupils' perspective, as reflected in their responses to several questions on discipline in the PISA questionnaire. The section following it examines the topic of discipline via data on punctuality and truancy, which are less susceptible to subjective bias and differing attitudes from nation to nation regarding classroom behavioral norms.

Disciplinary level as reported by pupils

In the PISA questionnaire, three statements about mathematics lessons were posed to the pupils that related directly to classroom discipline levels: "Students don't listen to what the teacher says," "There is noise and disorder," and "The teacher has to wait a long time for students to quiet down. For each of these statements, the pupils had to mark one of the

²³ For a theoretical discussion, see Lazear (2001). For empirical research, see Arum and Velez (2012), a collection of articles on discipline and scholastic achievement that also includes Shavit and Blank (2012), a study of the impact of disciplinary problems in Israel (an earlier version of which appears in Shavit and Blank (2011)). Another study of the impact of disciplinary problems in Israel is Shavit and Blank (2013).

following responses: “Every lesson,” “Most lessons,” “Some lessons,” and “Never or hardly ever.”

Figure 22 shows that when compared with the all-country average and the ten leading countries average, the percentage of Israeli pupils who answered “Never or hardly ever” to the statement, “Students don’t listen to what the teacher says” is very high, while the percentage who answered “Most lessons” or “Every lesson” is low. This does not necessarily suggest that the level of attentiveness in the average Israeli classroom is much higher than the world average since the data are based on pupil self-reporting, which is subject to substantial cultural bias. Nevertheless, as shown by Figure 23, both in Israel and internationally the average PISA math score rises as pupils report higher levels of attentiveness in the classroom.

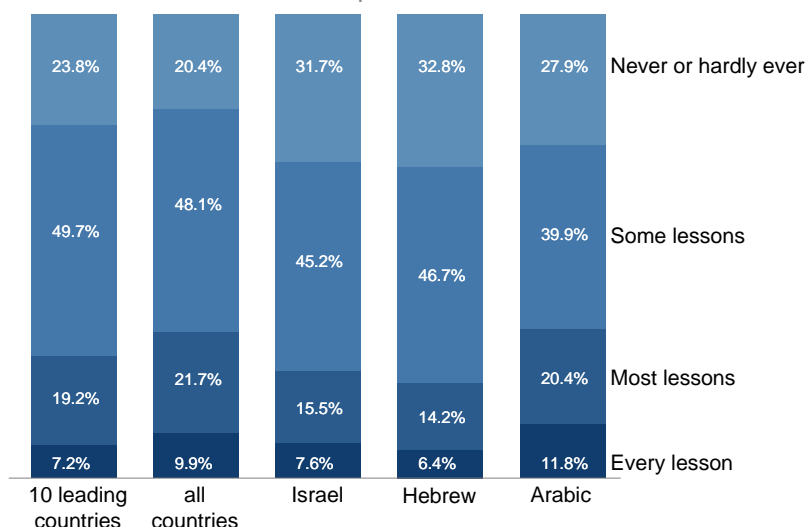
The results for the statements “There is noise and disorder” and “The teacher has to wait a long time for students to quiet down” are very similar: according to Israeli pupil reports, math lessons are conducted in exemplary silence and orderliness compared with lessons in the rest of the developed world. For these statements as well, the average score rises along with the level of classroom quiet and order attested to by pupils, as can be seen in Figures C4 and C6 in Appendix C.

Assuming that cultural bias is smaller within a country’s education system than between different education systems across countries, it is not surprising that these figures show a major advantage for pupils in classrooms where discipline levels are high.²⁴ A statistical weighting via factor

Figure 22

“Pupils don’t listen to what the teacher says”

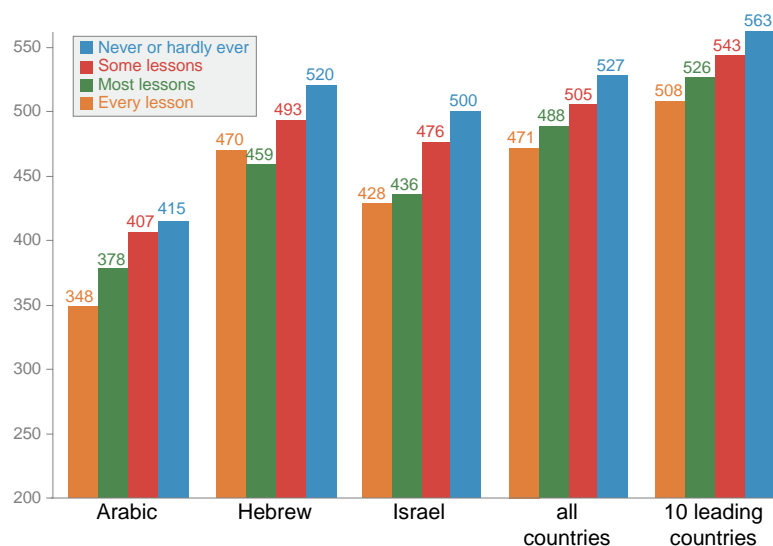
distribution of responses to statement



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 23

Average score by response to statement “pupils don’t listen to what the teacher says”



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

²⁴ A correlation may exist between classroom behavior and learning ability, which can lead to reverse causation (high-achieving pupils behave well, rather than the opposite). However, the multiple regression outcomes in Appendix B show that the impact of discipline remains significant even when maternal education level, a strong determinant of pupil ability, is taken into account.

analysis of the responses to the three statements produces an index of subjective classroom discipline, as reported by pupils (Figure 24).²⁵ Israel has greater classroom discipline, in subjective terms, than all other developed countries except Japan and Hong Kong.

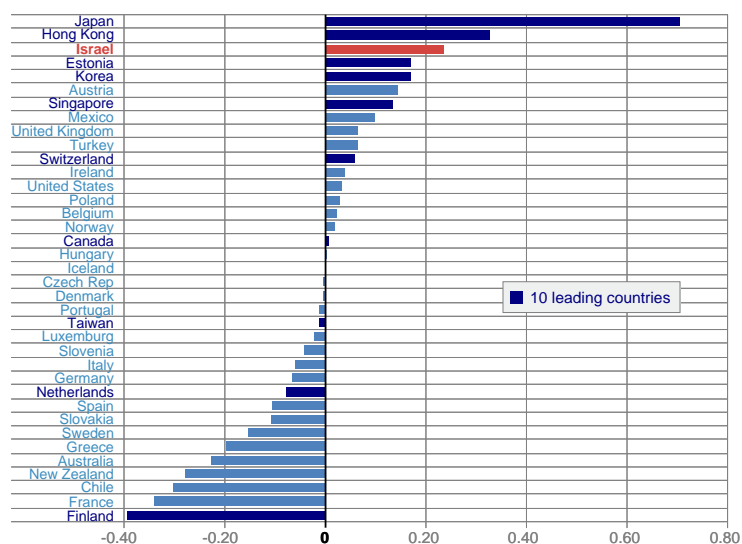
Compared with the rest of the developed world, Israeli pupils themselves see no problem with the prevailing discipline level. But this does not necessarily indicate that the learning atmosphere is actually good. Instead, it may be an indication of large normative gaps in attitude between the average Israeli pupil and his peers in the developed world as to what constitutes “discipline”. To ascertain this, somewhat more objective data are required. The following section discusses Israeli discipline levels on the basis of data on punctuality and truancy, which are less susceptible to cultural bias in their reporting.

Measuring discipline levels on the basis of data on punctuality and truancy

Lack of punctuality and truancy have a direct negative impact on pupils themselves, who lose study time. They also affect the entire class by creating gaps in knowledge that then have to be addressed. Beyond this, data on punctuality and truancy also provide a more objective indication of classroom and school-wide discipline. The PISA questionnaire questions pupils about the number of times that they arrived late without permission, the number of their unauthorized full-day absences, and the number of times they skipped class (without skipping the entire school day) without permission, during the two weeks that preceded the test.

As Figure 25 shows, Israel’s showing is much worse than the all-country average with

Figure 24
Subjective discipline index*

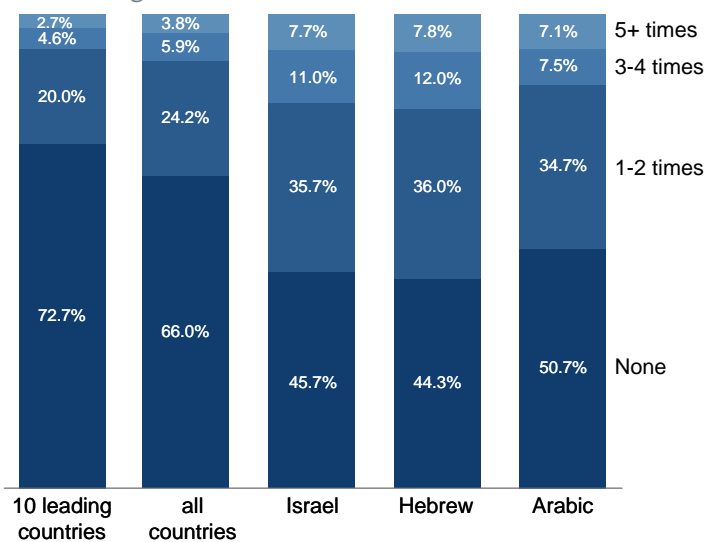


* Computed using the factor analysis method. Zero represents the all-country average level of subjective discipline (based on student impressions). The higher the index, the greater the discipline.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 25
Incidence of tardiness to school*

During the two weeks before the PISA test



* Sums to 100%.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

²⁵ The index is based on the factor analysis method, a statistical method that calculates a joint factor for a number of correlated variables. The discipline level here is a factor that lies behind the pupils’ answers to the three statements. The index obtained is standardized for a mean of zero and a standard deviation of one unit (one).

regard to pupils' punctuality. The share of pupils who were tardy five or more times without permission is double the all-country average. The percentage of pupils who arrived late 3-4 times is also double that of the developed world. Even the percentage of Israeli pupils who were late once or twice is 11.5 percentage points higher than that of all of the comparison countries. Therefore, it is not surprising that the percentage of Israeli pupils who were never late during the two-week period is 20 percentage points lower than for all countries. It should be noted that in Israel's Arab sector the situation is somewhat better than in the Jewish sector, though it is still much worse than that of all of the comparison countries.

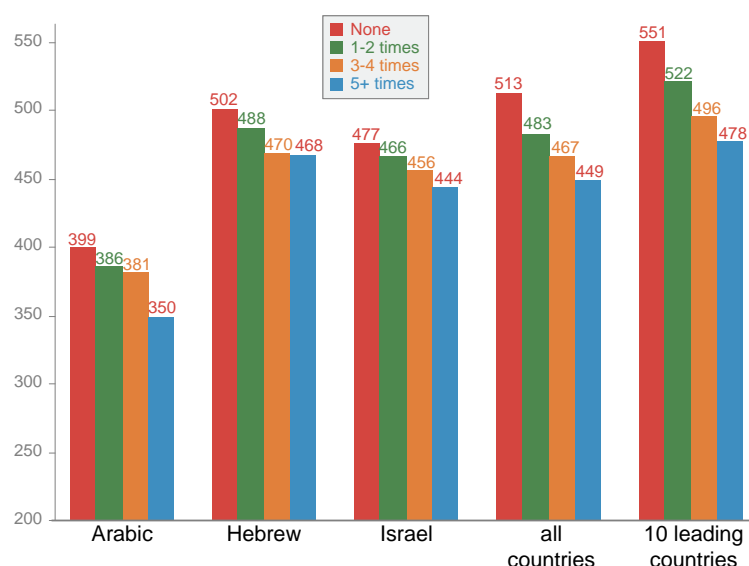
As in the case of the subjective statements regarding discipline, the data on lack of punctuality correlate with pupil exam scores, as can be seen in Figure 26. Here too, gaps persist between the Hebrew and the Arab systems, as do those between Israel and the rest of the world – all countries and the ten leading countries.

There is a simplistic explanation for the negative correlation between the incidence of tardiness and test scores. It is likely that, on some of the occasions, it was to their math lesson that the pupils were late to, meaning that they missed class time and material and accordingly lagged behind the rest of the class. However, it is also likely that tardy pupils are also less disciplined pupils who attach less importance to their studies. Additionally, it is reasonable to assume that the classes in which a high percentage of the pupils who came late are classes whose discipline level is low.

Table 3 presents the distribution of pupils by the intensity of their tardiness in Israeli classrooms, in all countries and in the ten leading countries. For each group, the most prevalent classroom incidence of tardiness is marked in yellow. In the ten leading countries, nearly half of the pupils are in “punctual” classes, where latecomers account for no more than a quarter of the class. In all countries, only 35% of pupils are in “punctual” classes while in Israel, this share sinks to just 3% of the pupils. Punctuality, considered a desirable and even normative trait in much of the developed world, is rare in the Israeli education system. At the other end of the spectrum, “unpunctual” classes, where over 75% of the pupils arrived late at least once during the two weeks before the test, are much more common in Israel (11%) than in the developed world (2-3%). This situation

Figure 26

Average score by number of unauthorized school tardies



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Table 3

Distribution of pupils by intensity of tardiness

percent of pupils who were tardy at least once during the two weeks before PISA test

share of tardy pupils in class	10 leaders		all countries	Israel
	10	leaders	all countries	Israel
up to 25%	49%	35%	35%	3%
25%–50%	36%	43%	43%	33%
50%–75%	13%	20%	20%	53%
above 75%	2%	3%	3%	11%

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

underscores the great difference between how the Israeli education system and the education systems of the developed world conduct themselves.

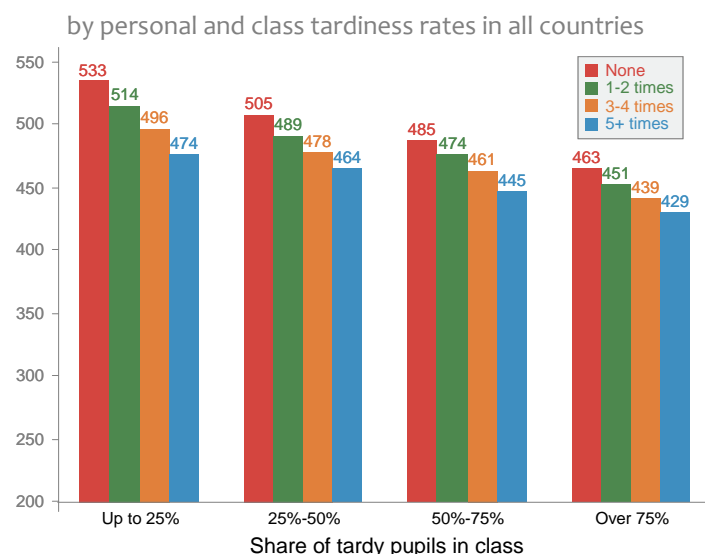
Classroom breakdown by tardiness rates in all of the countries makes it possible to test the correlation between classmates' lack of punctuality and test scores (Figure 27). Pupils' scores rise when their personal tardiness rates decline, and they rise even more when their entire class tardiness rates fall. The average score of a "punctual" pupil – i.e., one who was not tardy at all – enrolled in an "unpunctual" class, where 75% of the pupils were tardy at least once, is lower than the average score of an "unpunctual" pupil who was tardy five or more times and is in a habitually "punctual" class where the tardiness rate does not exceed 25%.

This relationship is also observable in the Hebrew education system (Figure 28). A comparison of Figures 27 and 28 shows that the average score of pupils in the Hebrew system is consistently higher than the all-country averages in all instances except one: pupils who were late 3-4 times and are in a class where 25%-50% of the pupils are tardy.

No similar comparison may be conducted within the Arab education system, as pupils in that system are overwhelmingly concentrated in classes where 25% to 75% of the pupils come late. In Arabic speaking classes where no more than 25% of pupils are tardy, there are 37 pupils, while in classes where 75% or more of the pupils arrive late there are only 17 pupils.

Figure 29 shows that the average scores of pupils in the Hebrew speaking system are higher than the all-country averages in all four class tardiness groups. The fact that the average score of all Hebrew speakers is below the all-country average indicates that even top Israel pupils are often late and suggests just how pervasive the tardiness phenomenon is in Israel. Put differently, the underlying reason for the achievement gap between Israel's Hebrew speakers and the all-country average is Israel's high prevalence of low discipline levels.

Figure 27
Distribution of scores



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 28
Distribution of scores – Hebrew speakers



* Sample size for tardy pupils is too small.

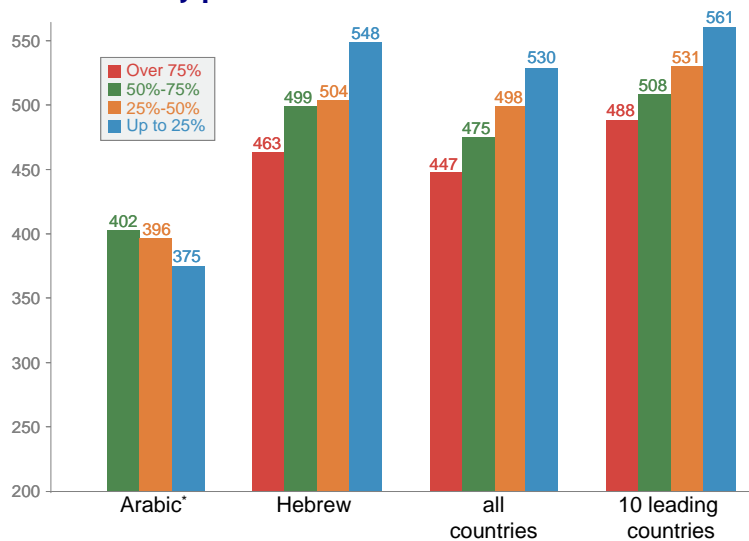
Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

In the Arab education system, the correlation between classroom tardiness rates and average score appears to be the reverse of what is found elsewhere in the world. This is apparently due to the fact that the Arab system's class tardiness rates are concentrated around the center of the distribution (50% tardies), and that there are few pupils at the extremes (37 pupils in classes of up to 25% tardies and 17 pupils in classes of 75% or more tardies).

The remaining data on truancy and skipping class paint a similar picture. Full-day absences are rarer than tardies, but here too, Israel stands out in a negative sense. The percentage of pupils with no absences is 16 percentage points lower than for all countries, and 22 percentage points below the ten leading countries (Figure C7 in Appendix C). Moreover, the percentage of Israeli pupils who were absent many times (3-4 times and five or more times) is double that of all countries, and four times that of the ten leading countries. Like the lack of punctuality, truancy also exhibits a high negative correlation with scores (Figure C8 in Appendix C). Skipping classes without authorization, like tardiness and full-day absences, is also common in Israel, and especially in the Hebrew education system – much more so than in the rest of the developed world (Figure C9 in Appendix C).²⁶

The picture that emerges from the tardiness and truancy data (relating to full days and to skipped classes) is diametrically opposite the one painted by pupils' subjective impressions regarding the discipline levels of their classes. Each one of these objective measures indicates that Israeli discipline levels are substantially below those of most countries in the developed world. Indeed, in a statistical weighting of the data on tardiness and truancy via factor analysis, Israel's objective discipline level places the country third from last in the developed world (Figure 30), above only Italy and Turkey. Both Israel's ranking and the magnitude of its index make it considerably different than most of the other countries.²⁷ For example, the difference between Israel's discipline level and that of Canada (0.34) is larger than the difference between the discipline levels of Canada and Finland (0.27), even though

Figure 29
Distribution of scores
by personal and class tardiness rates



* In the Arabic speaking school system, there were insufficient observations in classes with over 75% tardies, and there are only 35 pupils in classes with up to 25% tardies.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

²⁶ While in the developed world and in Israel's Arab education system, skipping class clearly correlates with low average scores, in Israel's Hebrew education system this is not the case (Figure C10 in Appendix C). In fact, the average score of pupils who did not skip any classes is the lowest. It could be that, while in the developed world and in Israel's Arab education system such absences point to non-normative behavior on the part of problematic pupils, and are more common in classrooms whose discipline levels are low, in the Hebrew education system it is actually the better pupils who can afford to be absent more often, as they are confident in their ability to make up the material they have missed.

²⁷ The index is standardized for a mean of zero and a standard deviation of one unit (one).

the difference in rank between Canada and Finland is ten places, while the difference in rank between Canada and Israel is only four places.

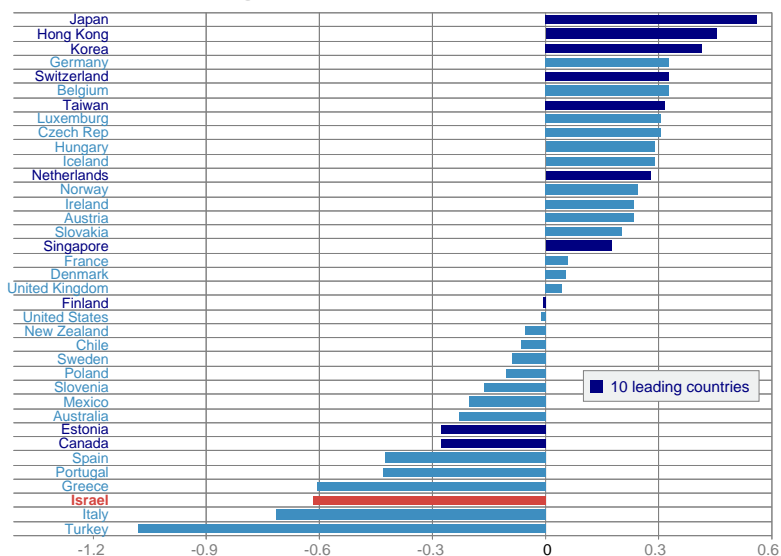
The measured discipline level reinforces many cultural stereotypes: the East Asian and Northern European countries are at the top of the ladder, while the Mediterranean countries (and Portugal) occupy the bottom rungs. From this perspective, Israel's discipline level corresponds closely to its geographic location. The major advantage of using data on lack of punctuality and truancy to evaluate discipline levels is the degree of their objectivity and lack of cultural bias emanating from subjective responses to direct questions on classroom disciplinary atmosphere. But are data on tardiness and truancy in fact reliable indicators of classroom discipline level?

To examine the relationship between data on tardiness and truancy (both skipped classes and full day absences) and data on subjective discipline data based on pupil responses to questions about classroom atmosphere, an index of the subjective measure was regressed on the objective classroom average discipline level. A dummy variable for the various countries was included to deduct the impact of cultural bias, that is, the difference between countries in attitudes toward discipline.²⁸

The regression results confirm a statistically significant and strong positive relationship between the objective and subjective discipline measures, after controlling for cultural bias at the country level (Table B1 in Appendix B). In other words, the data show that, on average, classrooms where tardiness and truancy are common are also characterized by low levels of discipline during lessons.

As can be seen in Figure 31, a partial correlation can be readily detected between objective discipline levels and mean country

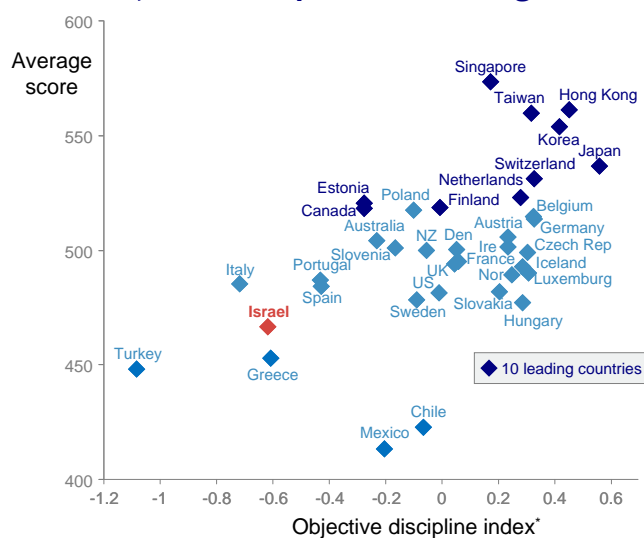
Figure 30
Objective discipline index*
using truancy and tardiness data



* Factor analysis method.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 31
Objective discipline* and average score



* Factor analysis, using truancy and tardiness data.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

²⁸ The regression made use of variance adjustment for clustering which was carried out at the level of 771 schools.

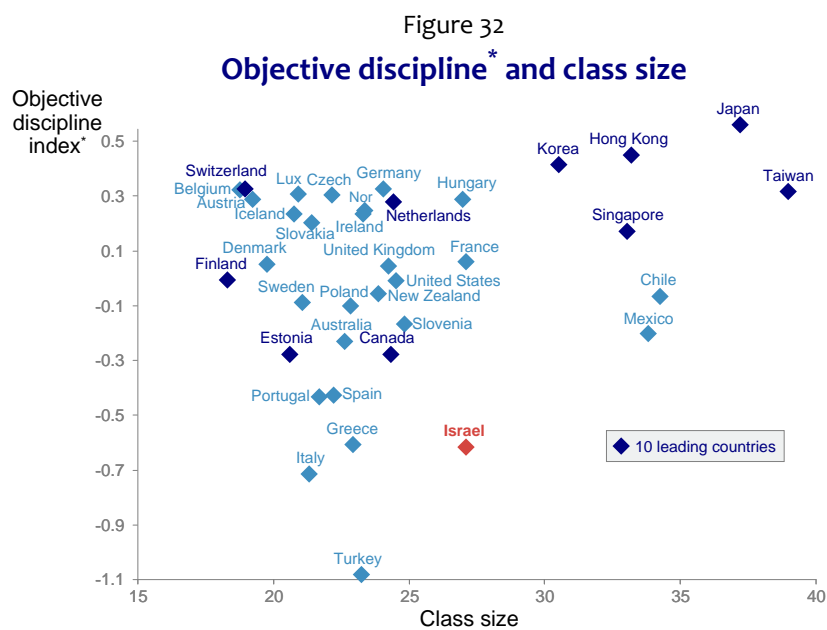
scores.²⁹ Of the ten leading countries, the East Asian nations, Switzerland, and the Netherlands exhibit very high discipline levels; by contrast, Finland's discipline level is average in relation to the West, while Estonia's and Canada's discipline levels are below most of the countries. Some of low-scoring countries, such as Turkey, Greece and Israel, and to a lesser degree Italy, Spain and Portugal, are characterized by low discipline levels. However, the lowest-scoring countries in the developed world – Chile and Mexico (which are included in the comparison because they are members of the OECD) – actually have discipline levels near the average for all countries.

Figure 31 shows that while a correlation between discipline levels and achievements exists, it is far from perfect, and that there are undoubtedly additional influencing factors. The theoretical analysis provided by Lazear (2001) points to a reciprocal relationship between discipline levels and class size. Specifically, the bigger the class, the greater the degree to which low discipline levels will compromise achievements. As will be shown below, this theoretical hypothesis is supported by the data.

Figure 32 presents both objective discipline level and class size. Of the ten leading countries, the five Asian ones display high discipline levels and large classes, while the five Western countries are characterized by lower discipline levels and smaller classes. The graph broadly suggests a diagonal along which the ratio between discipline level and number of pupils per class is maintained. Countries that deviate from this ratio for the worse, where discipline levels are low relative to countries of similar class size, such as Chile, Mexico, Turkey, Israel, Greece, and Italy, and to a lesser extent Spain and Portugal, are also characterized by low achievements on the PISA test.

Nevertheless, it is also clear that while high discipline levels and small classes may help pupils reach high achievements, they do not guarantee them. For example, Canada's PISA performance is better than that of many countries where discipline levels are higher and average class sizes are smaller.

To simultaneously weigh the impact of the numerous factors on pupil achievements in all of the countries, three regressions were performed (Table B2 of Appendix B). All three regressions include maternal education level, paternal education level, the classroom shares of parents with post-secondary education, the number of math lessons per week, the number of private math lessons per week, class size and a dummy



* Factor analysis, using truancy and tardiness data.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

²⁹ The correlation is 0.55.

variable for Israel's Arabic-language test-takers. The discipline data (subjective and objective, personal and class-wide) are included in various combinations in the three regressions.

In all three regressions parental education level carries great weight in pupil achievements, maternal education level having a stronger impact than paternal education level.³⁰ Additionally, the share of parents in a class who have post-secondary education has a very large and significant impact on pupil scores, a contribution that is in addition to the one noted above emanating from the education levels of individual pupil's parents.

The average score increases along with the number of math lessons per week in the school, though this finding needs to be interpreted with caution. It is reasonable to assume that the pupils who spend more hours in math class per week are also in higher ability groupings, meaning that they have higher mathematical aptitude – which is an unmeasured factor that contributes to high test scores alongside the number of math lessons. In contrast to the number of math lessons in the school setting, private math lessons are actually correlated with lower scores. Here too, caution is warranted when interpreting the finding, as private lessons are often given to weaker pupils, as shown by Figure 17.

Like the findings in Figure 20, the results of the regressions indicate a positive correlation between math score and class size, that is, larger classes have higher mean scores. This finding should also not be taken at face value – the more disciplined and motivated the pupils, the less individual attention they need and the more practicable it is to teach them in larger groups. By contrast, smaller classes tend to be special education classes. As already noted, this does not mean that if small classes are enlarged, their achievements will improve.

Finally, the coefficient for the dummy variable representing Israel's Arabic speaking test-takers ranges from minus 58 in Regression (1) to minus 42 in Regression (2) in Table B2. What this means is that, on average, an Arab Israeli pupil will achieve a significantly lower outcomes than an Israeli Jewish pupil, even when the rest of the regression variables – parental education level, number of math lessons, class size, and discipline level – are identical. That said, a large portion of the 101-point gap in average scores between Hebrew-language test-takers (489) and Arabic-language test-takers (388) stems from demographic variables, first and foremost the education level of the pupils' parents.

The impact of discipline is assessed both at the personal level – that of the individual pupil – and at the classroom level, where the classroom discipline mean is multiplied by dummy variables representing different class sizes. The positive impact of objective discipline, both personal and classroom, on pupil scores was found to be positive and statistically significant.³¹ In addition, classroom discipline gains in importance as class size grows, as also shown by Figure 33. This new empirical finding matches well with the theoretical model presented in Lazear (2001).

Accordingly, the negative impact of low discipline levels in Israel's education system is intensified by the country's large class sizes. The combination of low discipline levels and large classes is calamitous – large classes do not foster self-expression, and the low discipline levels are detrimental to effective learning.

³⁰ In all three regressions the variance matrix is assessed via clustering at the level of 769 schools.

³¹ The effects of the various types of discipline are statistically significant at the 1% level, except for classes of up to ten pupils, where the impact is significant at the 5% level (Table B2 in Appendix B).

These findings underline the important role that of improved discipline levels have on better scholastic performance. In light of Israel's large class sizes, this finding has particular importance for the country.³² For example, if Israel's discipline index were to improve and rise to zero (the mean for pupils in all countries), such an improvement of 0.62 in the objective discipline index could be expected to directly raise the country's average score by 20-25 points, to 490 (6-9 places in the OECD rankings). Moreover, because such an increase in discipline would also substantially improve teacher work conditions and occupational status, it could help attract quality personnel to the teaching profession, leading over time to an additional rise in Israeli pupils' achievements.

Teacher quality

Teacher quality, together with teacher motivation and sense of mission, are critical for holding pupils' interest and to teach in depth. As noted above, teacher quality and discipline level have reciprocal effects.

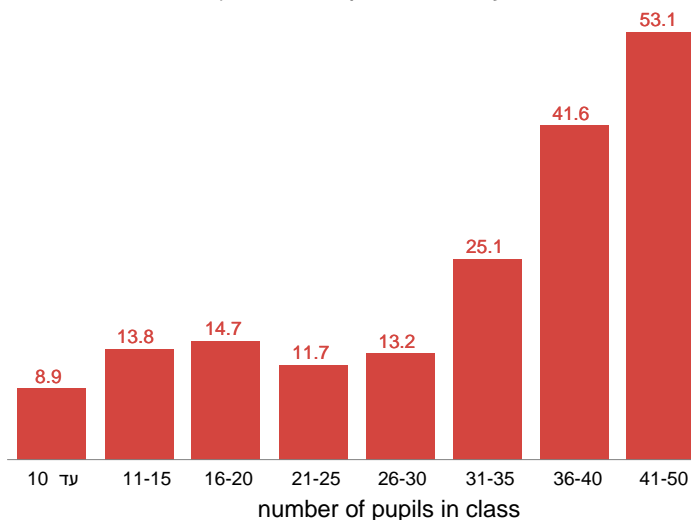
It is hard to accurately assess teacher quality. The PISA school principal questionnaire includes questions about the education level of teachers in the tested subjects, and on their full-time or degree of part-time positions. According to the responses, the education level of Israeli mathematics teachers is similar to that of their counterparts in the ten leading countries (Table 4). The percentage of full-time teachers is somewhat low, though higher than in the Netherlands or Switzerland. In any event, a statistical analysis on teacher education levels and share of full-time positions indicates that these have no significant impact on pupil scores.

This suggests that teachers' levels of formal training have little bearing, if any, on the quality of their teaching. The caliber of those entering the teaching field

Figure 33

Impact of discipline on score, by class size*

Addition to score as a result of increasing the class objective discipline index by one unit



* Addition to score after controlling for country, parental education (of the pupil and of the class average), hours of mathematics, private lessons, class size and individual discipline.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Table 4

Teacher education and percent position

	academic degree	degree in mathematics	degree in teaching	full-time position
Israel	84.4%	62.5%	47.0%	68.0%
10 leading countries	86.2%	58.0%	44.0%	82.4%
Estonia	95.0%	73.5%	82.9%	76.8%
Netherlands	20.1%	15.8%	2.9%	46.4%
Hong Kong	97.2%	55.3%	26.3%	97.9%
Taiwan	94.3%	76.1%	41.3%	93.7%
Japan	100.0%	no data	no data	89.1%
Singapore	98.2%	67.5%	72.1%	94.8%
Finland	96.9%	62.7%	26.9%	93.1%
Korea	100.0%	72.3%	24.4%	89.7%
Canada	97.1%	63.3%	60.2%	80.7%
Switzerland	62.9%	35.3%	58.7%	61.6%

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

³² As Figure B1 in the Appendix shows, the gaps in discipline levels between Israel and the developed world persist, and in fact grow, in classes with large numbers of pupils.

appears to be much more important than the training they receive. A high caliber and a large candidate pool make it possible to choose the best, and to provide those chosen with intensive and in-depth training.

A qualitative look at the ten leading countries' education systems indicates that in all of these countries, teachers' social status is very high, which in turn creates a strong demand for the teaching profession. For example, in Finland teaching is considered to be the most respected and desirable of all occupations. In Japan, where teaching has been a prestigious occupation since the days of the Meiji Restoration in the latter half of the 19th century, when most teachers belonged to the samurai class, only 14% of applicants to teacher training schools are accepted. Of this group, only 30% to 40% are eventually hired to work in public schools. Only an eighth of candidates for teacher training in Singapore are admitted while in Canada, most applicants for teaching jobs are drawn from the top 30% of their college graduating classes. In each of the ten leading countries there is high public and governmental awareness of the importance of attracting quality manpower to the teaching profession.³³

In comparison, the pre-academic background (matriculation and psychometric exam scores) of new education students in Israel is particularly weak. Table 5 displays the mean psychometric scores of education and teaching students in the various types of higher education institutions. In each type of institution, the average psychometric score of education/teaching students is low relative to the average for all students. The vast majority of education students are trained by academic colleges of education, where the average psychometric score is 494. The matriculation exam scores of education students are also relatively low (Central Bureau of Statistics, 2015b).

Table 5 provides clear evidence that the teaching field in Israel does not, as a rule, succeed in attracting students whose qualifications enable them to be admitted to other professional study tracks.

What determines teachers' social status and attracts quality candidates to the profession? Is it simply a matter of salary? Table 6 displays the mean wage data of beginning and experienced teachers at the various education levels. Israeli teacher salaries are low relative to the OECD average, especially for beginning teachers in general and experienced secondary school teachers.³⁴ Compared with eight of the ten leading countries (data are lacking for Hong Kong and Singapore), the wage of beginning teachers in Israeli upper

Table 5
**Average psychometric exam scores
by first-year education students**
by type of institution, 2014/15 academic year

	public universities	public academic colleges	private academic colleges	teaching colleges
average of all students	617	539	516	
average of education	603	458	403	494
total number of students	519	849	428	6,800

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

³³ The data and conclusions drawn in this paragraph are based on surveys of the relevant countries' education systems that were conducted by the Center for International Education Benchmarking. See: <http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking>

³⁴ This is after implementation of the Ofek Chadash agreement that substantially raised teacher salaries in the primary schools and in some lower secondary schools, but before implementation of the Oz LiTmura agreement in the upper and some of the lower secondary schools. Oz LiTmura has since been partially implemented.

Table 6
Beginning and experienced teachers' salaries as share of GDP per capita
 full-time position, 2012

	beginning teachers' salaries (as share of GDP per capita)				experienced teachers' salaries* (as share of GDP per capita)			
	pre-school	primary	lower secondary	upper secondary	pre-school	primary	lower secondary	upper secondary
Israel	68%	61%	61%	58%	143%	127%	116%	115%
OECD average	no data	79%	83%	87%	no data	126%	132%	139%
Estonia	no data	69%			no data	101%		
Netherlands	76%		80%		112%		139%	
Taiwan	no data		100%		no data		176%	
Japan	no data	58%			no data	128%		131%
Finland	58%	68%	73%	78%	63%	89%	96%	103%
Korea	115%	117%	116%		326%		325%	
Canada	112%				71%			
Switzerland	53%	59%	67%	76%	81%	91%	102%	116%

* The experienced teachers' category refers to the maximum wage conferred by seniority.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research

Data: World Bank Education Statistics, OECD Statistics, Taiwan Ministry of Education

secondary schools relative to GDP per capita is the same as that of Japan, and lower than that of all of the other countries.

However, the data in Table 6 show that raising teacher wages would be only a partial solution. There are huge differences in salary levels (relative to GDP per capita) between the various countries; in some, wages are not fundamentally different from those in Israel. For example, the salaries of experienced Israeli teachers (relative to GDP per capita) are higher than those of their counterparts in Estonia, Finland, Canada and Switzerland.

The implication of these comparisons is that the impact of wage on the status of the teaching profession, and on the degree to which it attracts quality manpower, is limited. In most of the countries in Table 6 the teachers do not earn especially high salaries (Korea is a notable exception), but they do enjoy good teaching conditions, such as high discipline levels and/or small classes, which enable them to focus on teaching. These conditions create a positive feedback loop: quality manpower is attracted to the teaching field, which also raises the profession's status in the eyes of the public as well as disciplinary norms and the degree of respect shown to teachers in the classroom, which in turn helps to attract higher-caliber personnel. The opposite is also true – in all likelihood, a decline in disciplinary norms repels quality manpower and reduces the motivation of teachers already in the system. This in turn lowers teacher status, discipline levels drop even lower, and a negative feedback loop is created. It could be argued that the Israeli education system has been mired in a vicious circle of this kind.

Difficulty of math study from the pupils' perspective

Given the prevailing discipline problems, whose impact is intensified by large classes, it is doubtful to what degree Israel's education system is willing or able to challenge its pupils with difficult study material. On the one hand, there is constant pressure to increase the percentage of pupils eligible for matriculation in mathematics; on the other hand, there are burned-out teachers facing large classes with undisciplined pupils. In such a situation, it is reasonable to fear that the level of the material being taught might be compromised.

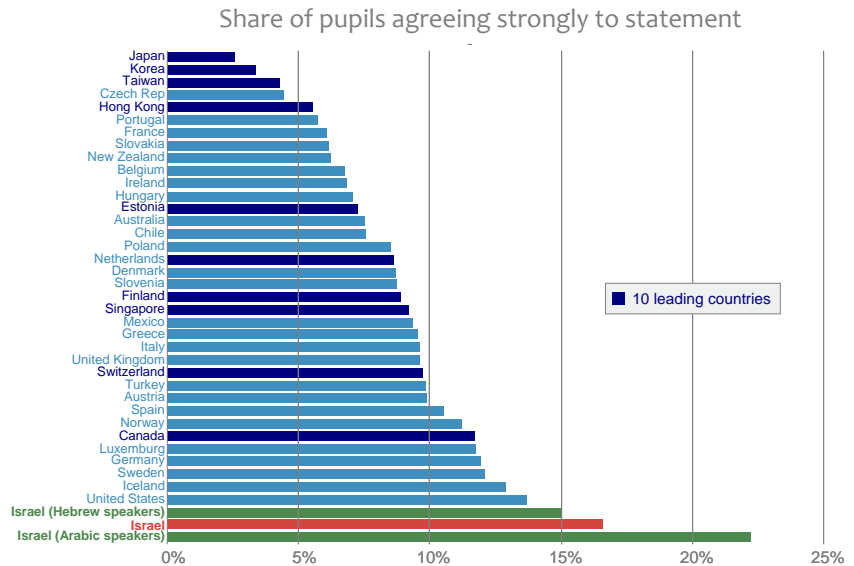
Aranovitch (2014) examined the level of Israel’s math matriculation exam from 1990 to 2014 and found that, despite a certain upward trend in the level of difficulty of matriculation exams over the last few years, the degree of complexity and the level of comprehension required for the 5-unit Israeli matriculation exams in math are lower than those required by the more difficult PISA questions. This raises the question of how Israeli pupils rate the difficulty of their material in comparison with how their peers do so in the other developed countries.

PISA test-takers are asked to rate their level of agreement (Strongly agree / Agree / Disagree / Strongly disagree) with the statement “In my mathematics class, I understand even the most difficult work.” As Figure 34 shows, Israeli pupils lead the developed world in terms of the confidence that they feel about the material studied in math class. Arab Israeli pupils are the most confident (22% strongly agree with the statement), but Jewish pupils are also highly confident (15% strongly agree) – much more so than pupils in the other countries.

In light of the Israeli pupil’s poor achievement levels, the findings in this table can be interpreted in two ways. One is that Israeli pupils are more arrogant than their peers in the other countries, and proclaim a confidence that has no basis in reality. The other is that the material studied in Israel, and especially in the Arab education system, is, in fact, less difficult. An examination of pupil scores by confidence level indicates that the confident pupils are the best at math (Figure 35), that is, their confidence is justified vis-à-vis other pupils in the same education system.

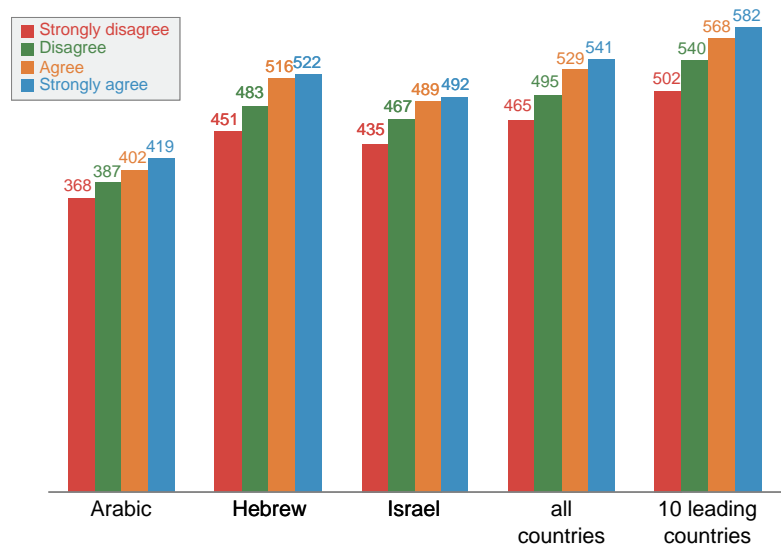
In terms of the distribution of responses to the aforementioned statement (Figure 35), it appears that, despite the positive correlation between confidence levels and mean scores within the various education systems, the mean level of confidence in the highest-achieving education systems is actually lower. A possible explanation for this is that pupils in the leading countries are exposed to higher-

Figure 34
“In my mathematics class, I understand even the most difficult work”



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure 35
Average score by response to statement “in my mathematics class, I understand even the most difficult work”



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

level and more challenging material, meaning that fewer of them feel that they understand “even the most difficult material” in math class. This explanation underscores the qualitative difference in complexity levels and in difficulty of material between the Israeli curriculum and the curricula common in the developed world, especially those of the ten leading countries.

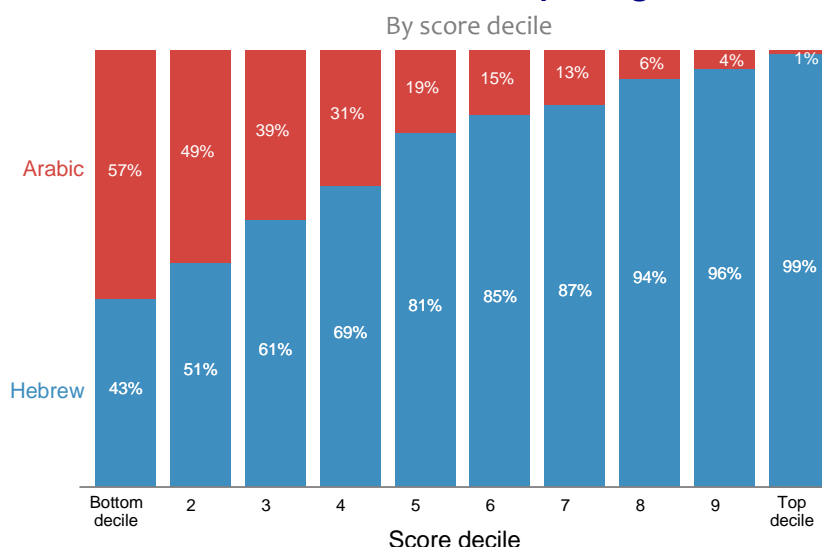
Achievements of Arab Israelis

There is a hundred-point disparity between the mean scores of Israel’s Hebrew-language (489) and Arabic-language (388) PISA participants. Arab pupils’ achievements are comparable to those of Jordanian pupils (386). Though there is an upward bias among Jews due to the absence of Haredi pupils, the share of Arab PISA participants’ in Israel’s lower PISA score deciles is nonetheless notable (Figure 36) and extends far beyond their relative share in the population. On the flip side, Arab representation in Israel’s upper score deciles is miniscule. This creates the impression that Arab Israeli pupils receive a third-world education – that, though enrolled in the education system of a developed nation, they do not benefit from it. This situation has major implications for the social gaps between Jews and Arabs in Israel, and for political relations between the two groups.

PISA data provide a look at gaps between pupils whose native language is Arabic and pupils belonging to other linguistic groups, in developed countries where the number of Arabic-speaking pupils is large enough for this kind of comparison (Table 7). In all of the countries in Table 7, the performance of Arabic-speaking pupils is lower than that of pupils from other language groups. This is not surprising, as immigrants from developing nations can be expected to reach lower achievements than do pupils of local origin in developed countries.

In the case of Israel, however, Arabic-speaking pupils are not immigrants. The disparity between them and their peers in other language groups is the largest, and the achievements of Israeli Arabic-speaking pupils is the lowest. This finding can be partly explained by the fact that immigrants are a higher-quality group relative to the population of the country they

Figure 36
Share of Hebrew and Arabic speaking test takers



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Table 7
Gap in PISA math scores between Arabic speakers and speakers of other languages in developed countries

	Native Arabic speakers	Speakers of other languages	Difference
Australia	471	504	-33
Denmark	437	501	-64
Belgium	439	516	-77
Sweden	412	479	-68
Israel*	394	483	-89

* Since the group of native Arabic speakers in Israel and the group of those taking the exam in Arabic is not completely identical, the average grade for each definition is slightly different.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

immigrated from.³⁵ Also, Arabic-speaking immigrants to developed countries are not a monolithic group. In Australia, for instance, most Arabic-speakers are Maronite Christians or Copts, relatively strong groups from a socioeconomic point of view.

In general, an examination of ethnic minorities' achievements in the ten leading countries reveals that social homogeneity is not a necessary condition for a quality education system. In Singapore, for example, pupils who speak English at home earned an average score of 602, while Chinese-speakers earned 582 and speakers of Malay 495. Although these inter-group differences are substantial, the mean score of Malay-speakers in Singapore is considerably higher than 421, the average for pupils in Malaysia,³⁶ and is at a level commensurate with a developed nation (higher than the average for Israeli Hebrew speakers). Had the average scores of Malay-speakers in Malaysia (a developing nation) and in Singapore (a developed nation with a state-of-the-art education system) been similar, one might have concluded that Singapore's Malay-speaking minority suffers substantial discrimination. It should be noted that the Singaporean education system is shared by all ethnic groups, and that the language of public education in Singapore is English, which is also the sole language in which PISA is administered there.

In Switzerland, by contrast, PISA is administered in German, Italian and French, with no notable difference in average scores (530, 533 and 534, respectively). In Canada the French-Canadian minority is tested in French, with an average score of 533 – higher than the average score in English (515). In Estonia there is a large Russian minority: a fifth of the pupils take the test in Russian, and their average score (496) is lower than that of the Estonian-language PISA participants, 527, but higher than the Russian average of 482. In Taiwan the test is given in Mandarin, but 14.4% of the test-takers report that they speak a different dialect at home. The group in question appears to be Taiwan's Hakka minority, which constitutes 15% of the local population. Their mean score is 517, lower than the mean score of Taiwan's Mandarin speakers (575). Finland has a small Swedish minority (6% of pupils), with no substantial difference between it and the Finish majority in average PISA math score. It should be noted that the average score of Finland's Swedish minority (521) is considerably higher than the average score for Sweden (478).³⁷ In the rest of the leading countries – Hong Kong, Korea, Japan and the Netherlands – the population is indeed largely homogeneous, or it is difficult to distinguish between population subgroups by PISA questionnaire data.

The conclusion is that the poor performance of Israel's Arab minority is not preordained. As the findings of the Table B2 regressions show, a substantial portion of the difference between Jewish and Arab pupils' achievements can be attributed to gaps in parental education level. Moreover, the gaps in parental education level between the Hebrew and Arabic education systems are indicative of major differences in the material resources that are available to the two systems, as areas with a high percentage of better-educated parents generally belong to affluent local authorities.

³⁵ See Chiswick (1999).

³⁶ The mean score of pupils in Malaysia who took the test in the Malay language (75% of all those tested in Malaysia) was 406. 25% of the Malaysians (a group composed, apparently, of Malaysians of Chinese and Indian background), took the test in English, earning an average score of 466.

³⁷ The data in this paragraph are based on an analysis of raw PISA data.

To overcome the lack of resources stemming from relatively low parental education levels, funding should be added to the Arabic-speaking education systems through differential budgeting as discussed in Blass, Zussman and Tsur (2010) and in Klinov (2010). Finally, it is proposed that outstanding Jewish and Arab pupils be encouraged to study together (perhaps once a week, as in frameworks for gifted pupils), thereby exposing outstanding Arab pupils to higher levels of instruction than they are accustomed to, and helping to raise the average level of the Arabic education system.

Summary and conclusions

The results of the PISA 2012 math assessment reveal that despite the non-participation of boys enrolled in the Haredi education system, Israel's education system nonetheless suffers from very low levels of achievement alongside a very high degree of inequality in comparison with the rest of the developed world. The inequality is both between Jewish and Arab pupils and within each of those groups. These outcomes yield grave implications for Israel's future competitiveness in the global marketplace, and for equality of earning ability within Israeli society.

In terms of the components of the educational process, Israeli pupils would appear, at first glance, to have a substantial advantage over most of the developed world. The education level of Israeli parents, and especially of Israeli mothers – a factor known to strongly influence pupil achievements – is very high. Moreover, the importance that Israeli parents and pupils attach to math study is the highest in the developed world, which also translates into a relatively large number of math enrichment lessons for Israeli pupils.

Thus, the reason for Israel's low achievements would seem to be rooted in poor quality of formal instruction. This study finds that a major cause of poor quality instruction is the low level of discipline in Israel's education system. In an assessment based on tardiness and truancy, Israel placed third from last in the developed world in terms of discipline. The findings show that the discipline situation worsens as classes increase in size.

In *Ethics of the Fathers* it is written that *derech erez* – what might be translated here as “appropriate behavior” – precedes the Torah. Getting to class on time, paying attention – or at least not disrupting the class – is appropriate behavior in which pupils should be instructed. It is the foundation on which the learning process is built. When this foundation is shaky, it is not surprising that the “Torah” – i.e., scholastic performance – is lacking. A strong education system needs to successfully impart disciplinary norms to its pupils. This will be reflected both in its punctuality/truancy data and in its classroom behaviors.

Strong systems are able to cope with problematic pupils and to maintain discipline levels. By contrast, weak systems capitulate to the behavioral norms that pupils bring to them. A weak system will not succeed in dictating to problematic pupils how to behave and is itself forced to adjust to these pupils. In such environments, problematic pupils may become social leaders who themselves dictate behavioral norms to their fellow pupils. The prevalence of tardiness and truancy in the Israeli education system – at levels much higher than those common in the developed world – indicates that Israel's education system is weak indeed.

In light of the findings regarding Israel's low discipline level and its impact on pupil achievements, it is advisable that education for attentiveness and discipline be identified as a major objective, with an emphasis on the younger age groups (pre-primary and primary school), so as to impart good study skills early on. This should be complemented by an effort

to achieve an appropriate staff/pupil ratio for these age groups. It is also crucial that the system back up teachers faced with disciplinary problems in all grades, not only to raise discipline levels but also to reinforce teacher authority and make teaching a more respected and attractive occupation.

Another measure that can contribute to an improvement in teacher status is that of raising the salaries of Israel's beginning teachers, which are low in international comparisons (relative to GDP per capita). That said, in most of the ten countries that lead the world in scholastic performance, teacher wages are not especially high relative to GDP per capita. To attract quality personnel who view teaching as their calling and as a means of contributing to society, exceptionally high salaries are not mandatory. Instead, the focus needs to be on improving instructional conditions.

The ten countries with the highest PISA 2012 math test scores not only exhibited high achievements, but also low levels of inequality between pupils (only Taiwan had a higher level of inequality than the all-country average). These leading nations succeed in bringing pupils of relatively weak backgrounds, as reflected in parental education levels, to high achievements. This is not the case in Israel, whose educational inequality is the highest in the developed world and whose pupils' achievements are strongly correlated with their parents' educational backgrounds.

Israel's education system is divided into several different systems. The Hebrew and Arabic systems are represented in the PISA assessment, but there is only very partial representation of the Haredi system as Haredi boys do not study much of the material and do not take the test. Extensive inequality exists within these systems as well between them.

With regard to inequality within the systems, parental education levels have a significant impact on all pupils in the classroom and not just on their own children. On average, pupils of less-educated parents studying in a "highly-educated" classroom perform better scholastically compared with pupils with highly-educated parents studying in "less-educated" classrooms. This underscores the great importance of cautiously and sensitively integrating pupils from socioeconomically disadvantaged backgrounds into strong schools. A small percentage of pupils from socioeconomically weak homes in a strong school will greatly improve these pupils' achievements without seriously compromising pupils of affluent backgrounds.

By contrast, a high percentage of pupils from weak backgrounds will have a substantial negative impact on the school's performance, cause pupils of stronger backgrounds to leave, and create a "ghetto" of socioeconomically disadvantaged pupils. Schools should, therefore, be encouraged to admit pupils from weaker backgrounds, but only in numbers proportional to their share in the population; they should, where possible, avoid concentrations of disadvantaged pupils at levels beyond their share in the population, as this could be expected to have a negative effect on the achievements of these very students.

Regarding inequality between the Hebrew and Arabic systems, efforts should be made on several fronts. First, differential budgeting should be implemented to help Arab schools, which usually belong to relatively poor local authorities. Second, part-time (one day a week) frameworks should be created where outstanding Jewish and Arab pupils can study together. Exposing outstanding Arab pupils to higher level instruction would improve their achievements and those of their classmates. Thirdly, labor market barriers that make it difficult to hire Arabs must be removed, especially for Arab women. This will increase the return on education in the Arab sector.

Finally, the fact that the education system for Haredi boys, which accounts for 8% of the relevant age group, chose not to participate in the PISA assessment (the most recent one and those that preceded it), raises concerns that the state of affairs presented in this study, grave as it is, does not fully reflect the magnitude of the problems facing Israel's education system.

Appendix A:

The International Standard Classification of Education (ISCED)

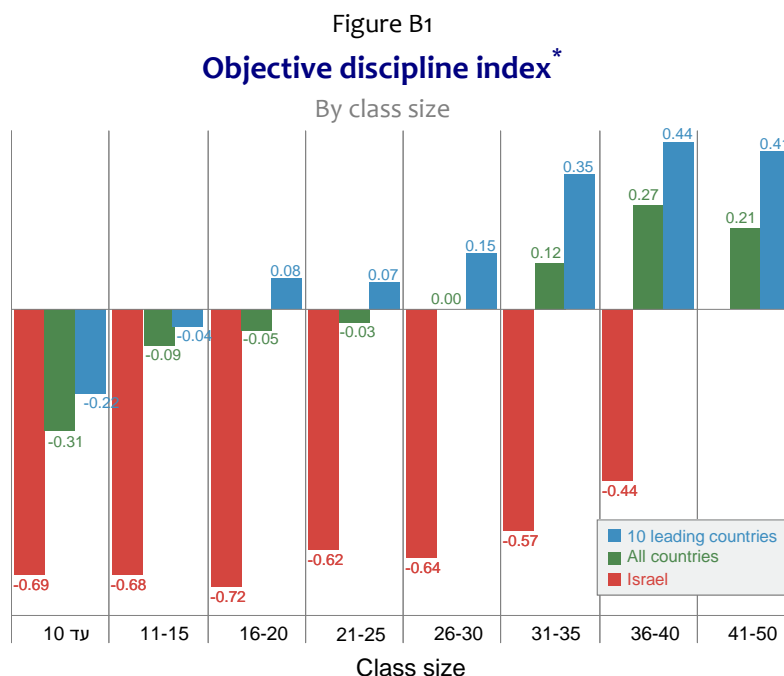
ISCED (International Standard Classification of Education) is a classification standard for levels of education, created by UNESCO. It is structured as follows:

ISCED 1	Primary education or first stage of basic education.
ISCED 2	Lower secondary or second stage of basic education.
ISCED 3A	Upper secondary education designed to provide direct access to ISCED 5A.
ISCED 3B	Upper secondary education designed to provide direct access to ISCED 5B.
ISCED 3C	Upper secondary education not designed to lead directly to ISCED 5A or 5B.
ISCED 4	Post-secondary non-tertiary education
ISCED 5A	First stage of tertiary academic education
ISCED 5B	First stage of tertiary non-academic education
ISCED 6	Second stage of tertiary academic education

The PISA data includes student-reported parents education divided to the following levels:

None	pre-primary or no formal education
ISCED 1	primary education (elementary school)
ISCED 2	lower secondary education
ISCED 3B, C	Upper secondary education not designed to lead directly to ISCED 5A.
ISCED 3A, 4	Upper secondary or post-secondary non-tertiary education designed to provide direct access to ISCED 5A.
ISCED 5B	tertiary non-academic education
ISCED 5A, 6	tertiary academic education

Appendix B: Statistical Analysis



* Factor analysis, using truancy and tardiness data.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research

Data: PISA 2012

Table B1
Subjective discipline as a function of objective discipline
regression results*

0.232*** (0.017)	Objective discipline index (class average)
-0.174*** (0.038)	Intercept
countries	Dummy variables
87,965	Number of observations
0.180	R ²

* standard deviations in parentheses.

*** statistically significant at the 1% level

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research

Data: PISA 2012

Table B2
Pupil scores as functions of personal and class characteristics
 Regression results, standard deviations in parentheses

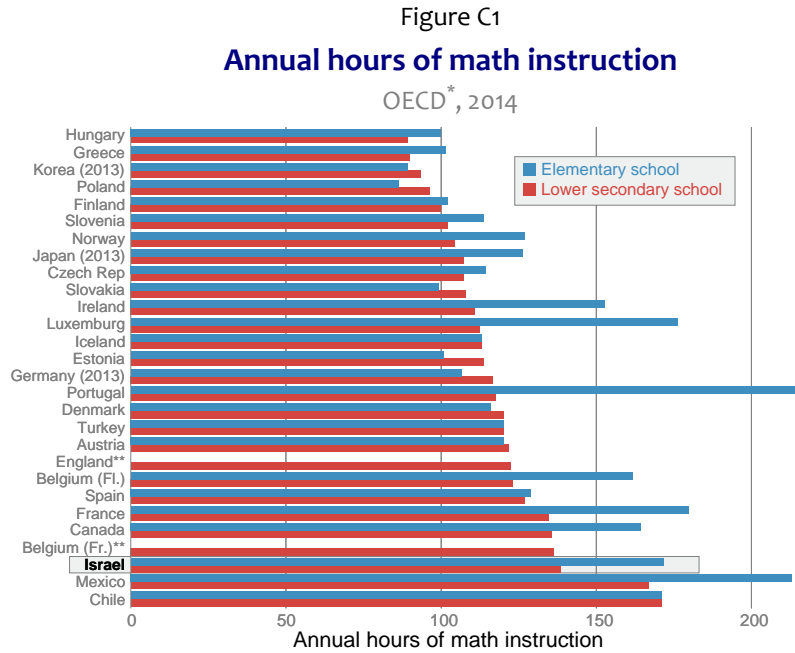
Variable		(1)	(2)	(3)
Mother's education	primary	15.86 (3.51) ***	15.92 (3.44) ***	15.63 (3.42) ***
	lower secondary	15.57 (3.25) ***	16.15 (3.19) ***	16.27 (3.13) ***
	high school without matriculation	25.05 (3.31) ***	26.05 (3.24) ***	25.14 (3.20) ***
	high school with matriculation	29.82 (3.53) ***	30.64 (3.42) ***	29.95 (3.37) ***
	certificate studies	29.15 (3.57) ***	30.21 (3.53) ***	29.49 (3.47) ***
	academic degree	37.94 (3.49) ***	38.79 (3.38) ***	38.19 (3.34) ***
Father's education	primary	3.18 (3.18)	3.85 (3.13)	3.33 (3.17)
	lower secondary	5.19 (3.08) *	6.40 (3.08) **	5.92 (3.12) *
	high school without matriculation	13.15 (3.84) ***	15.67 (3.81) ***	13.67 (3.79) ***
	high school with matriculation	15.59 (3.31) ***	17.30 (3.26) ***	16.07 (3.32) ***
	certificate studies	11.19 (3.63) ***	13.27 (3.60) ***	11.93 (3.60) ***
	academic degree	26.56 (3.68) ***	28.31 (3.60) ***	26.95 (3.65) ***
Share of parents with secondary education		132.73 (5.90) ***	125.08 (5.71) ***	124.57 (5.43) ***
Number of mathematics lessons in week		6.56 (1.13) ***	6.18 (1.09) ***	5.95 (1.06) ***
Number of private mathematics lessons in week		-5.49 (1.00) ***	-5.58 (1.00) ***	-5.64 (0.96) ***
Class size	10-15	15.50 (3.51) ***	16.22 (3.06) ***	15.28 (3.15) ***
	16-20	28.95 (3.59) ***	30.17 (2.96) ***	29.01 (3.21) ***
	21-25	38.10 (3.72) ***	40.49 (3.09) ***	38.52 (3.35) ***
	26-30	47.95 (4.35) ***	50.62 (3.62) ***	48.38 (3.91) ***
	31-35	52.97 (4.71) ***	56.66 (4.35) ***	53.15 (4.43) ***
	36-40	62.86 (5.98) ***	67.33 (6.16) ***	61.23 (5.79) ***
	41-50	62.89 (4.88) ***	70.61 (4.52) ***	62.98 (4.53) ***
Personal objective discipline		11.58 (0.66) ***		10.66 (0.64) ***
Class objective discipline times class size	up to 10	8.89 (3.90) **		4.23 (3.77)
	10-15	13.77 (2.83) ***		8.99 (2.97) ***
	16-20	14.69 (1.93) ***		10.52 (1.92) ***
	21-25	11.71 (2.02) ***		7.61 (1.99) ***
	26-30	13.23 (2.77) ***		9.00 (2.53) ***
	31-35	25.05 (4.04) ***		18.63 (3.64) ***
	36-40	41.57 (8.23) ***		31.64 (8.09) ***
	41-50	53.07 (11.90) ***		39.57 (8.50) ***
Personal subjective discipline			9.49 (0.68) ***	8.39 (0.66) ***
Class subjective discipline times class size	up to 10		26.90 (4.71) ***	23.45 (4.86) ***
	10-15		17.97 (2.78) ***	15.09 (2.95) ***
	16-20		15.97 (2.39) ***	13.74 (2.31) ***
	21-25		16.97 (2.48) ***	15.03 (2.44) ***
	26-30		19.58 (2.40) ***	17.76 (2.32) ***
	31-35		20.92 (4.78) ***	17.02 (4.27) ***
	36-40		36.73 (5.14) ***	28.74 (5.89) ***
	41-50		38.26 (8.46) ***	26.26 (5.73) ***
Arabic		-58.04 (3.45) ***	-42.04 (3.73) ***	-49.76 (3.38) ***
Constant		354.66 (8.19) ***	355.81 (7.51) ***	364.22 (7.60) ***
Dummy variables for countries		yes		
Number of observations		81,316		
R ²		0.33	0.33	0.35

* significant at the 10% level.
 ** significant at the 5% level.
 *** significant at the 1% level.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research

Data: PISA 2012

Appendix C: Additional Figures

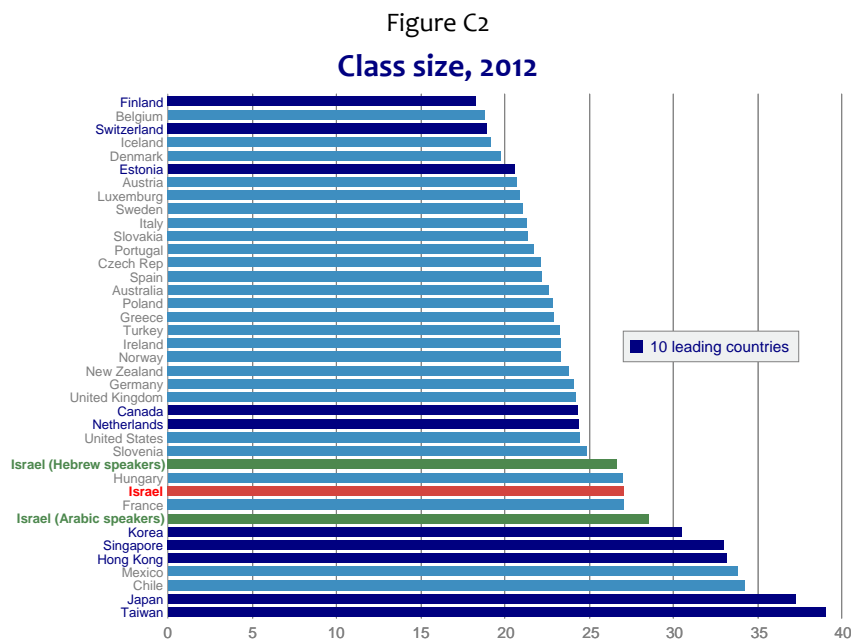


* Data for several OECD member states is missing.

** No data for primary school hours.

Source: Noam Gruber, Shoresh Institution for Socioeconomic Research

Data: OECD



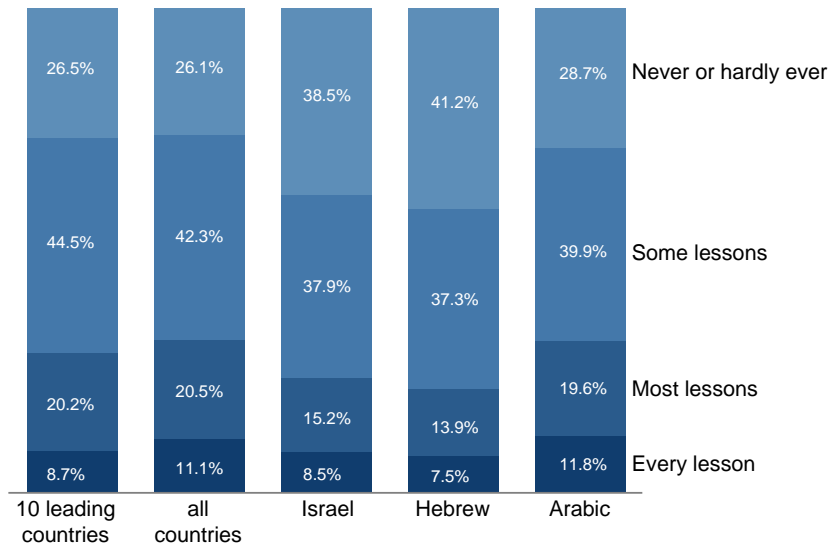
Source: Noam Gruber, Shoresh Institution for Socioeconomic Research

Data: PISA 2012

Figure C3

“There is noise and disorder”

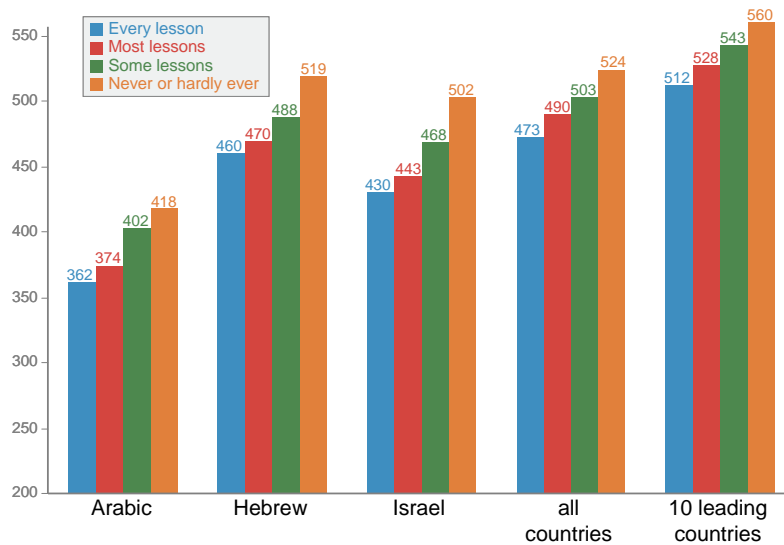
distribution of responses to statement



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

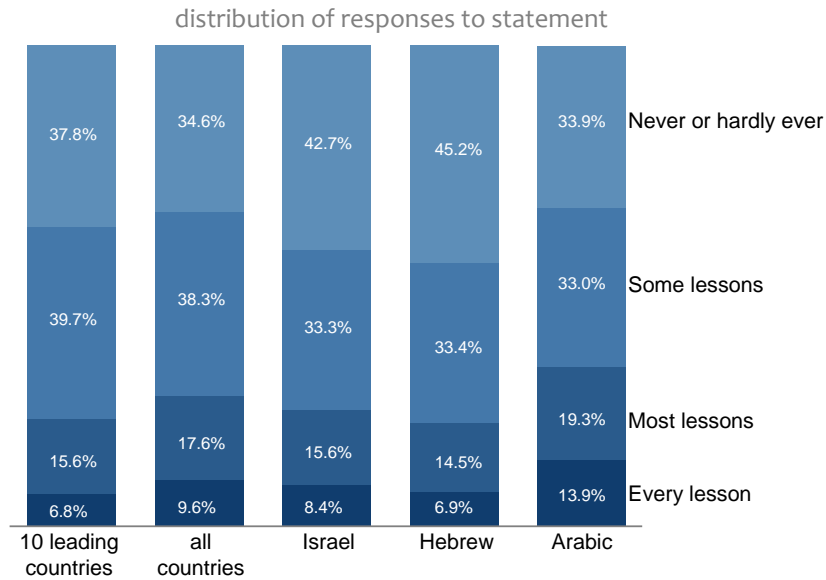
Figure C4

Average score by response to statement “there is noise and disorder”



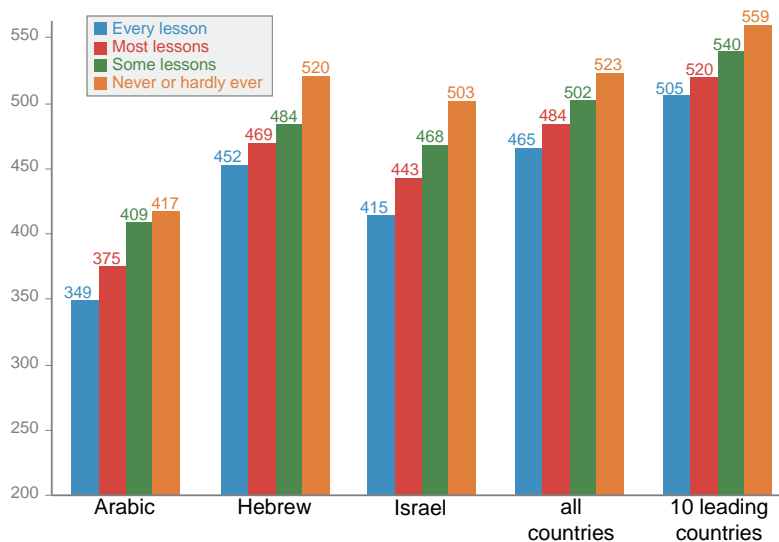
Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure C5
“The teacher has to wait a long time for pupils to quiet down”



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
 Data: PISA 2012

Figure C6
Average score by response to statement “the teacher has to wait a long time for pupils to quiet down”

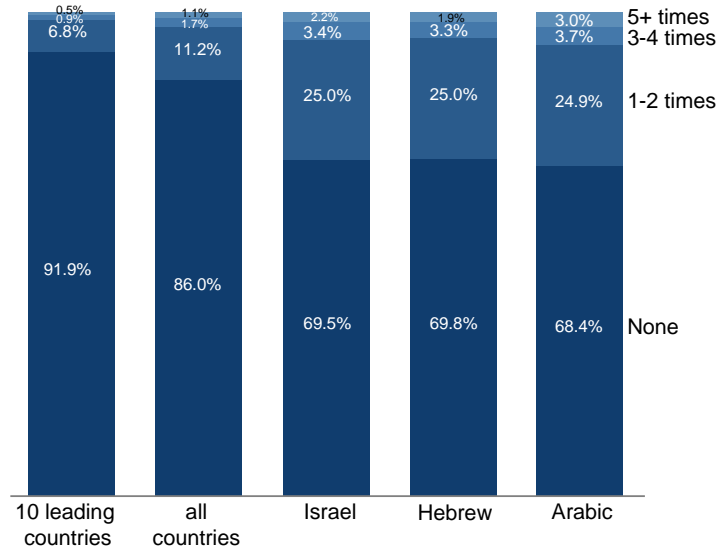


Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
 Data: PISA 2012

Figure C7

Incidence of full-day absences

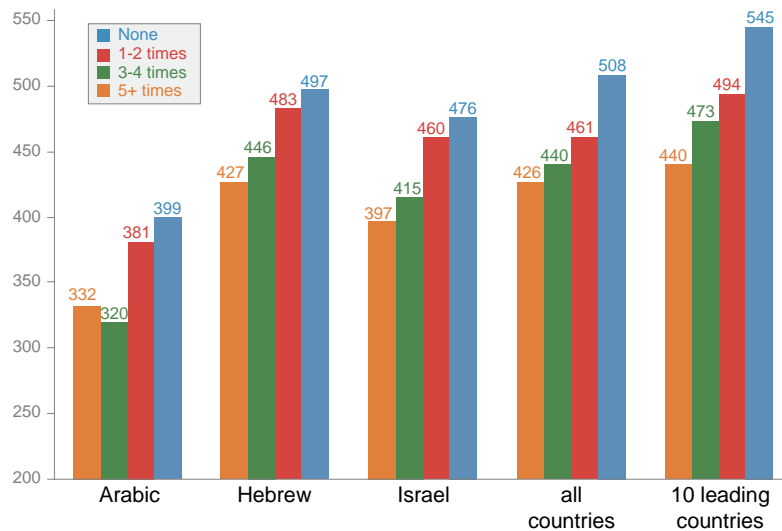
During the two weeks before the PISA test



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure C8

Average score by unauthorized full-day absences

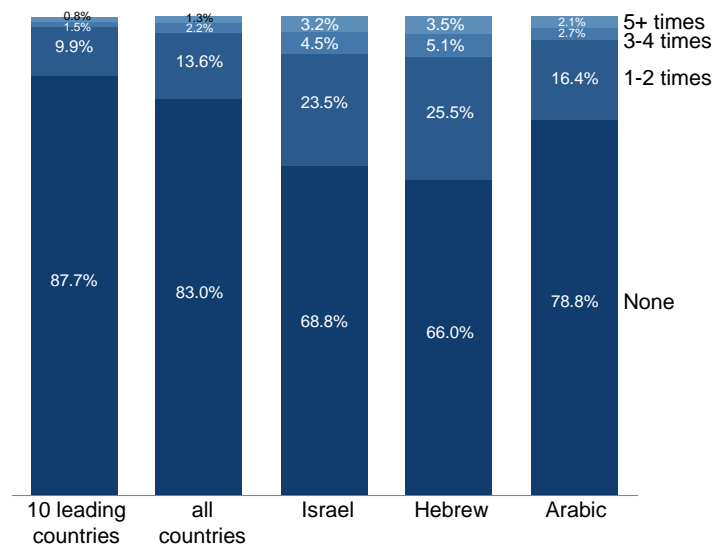


Source: Noam Gruber, Shoresh Institution for Socioeconomic Research
Data: PISA 2012

Figure C9

Number of days with unauthorized class absences per student

During the two weeks before the PISA test



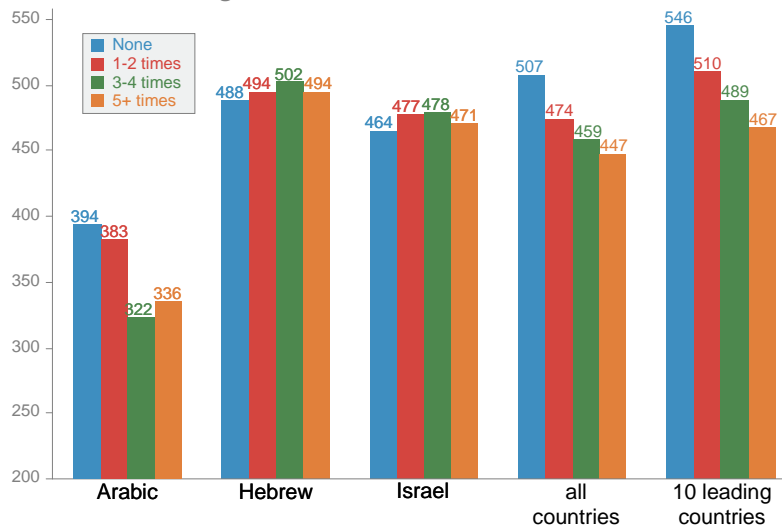
Source: Noam Gruber, Shoresh Institution for Socioeconomic Research

Data: PISA 2012

Figure C10

Average score by number of days with unauthorized class absences per student

During the two weeks before the PISA test



Source: Noam Gruber, Shoresh Institution for Socioeconomic Research

Data: PISA 2012

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