



January 17, 2017

Main Findings from the Trends in International Mathematics and Science Study (TIMSS) 2015 for Israel

Mathematics and Science Achievement of Israeli Eighth-Grade Students

The National Authority for Measurement and Evaluation in Education (RAMA) is pleased to present preliminary research findings for Israel from the Trends in International Mathematics and Science Study (TIMSS) 2015. TIMSS is managed and conducted by the International Association for the Evaluation of Educational Achievement (IEA). IEA is an independent international cooperative of national research institutions and government agencies that pioneered international comparative studies of cross-national educational achievement to gain a deeper understanding of the effects of policies across countries' different systems of education.

TIMSS is an international assessment of mathematics and science achievement at the eighth grade that has been conducted every four years since 1995. TIMSS series is monitoring trends in educational achievements, together with comprehensive data on students' contexts for learning mathematics and science. Israel has participated in this study since 1999. The 2015 study in Israel was conducted between April and May 2015 among a representative sample of 5,512 8th grade students studying in 200 formal schools (not including ultra-Orthodox and special education institutions).

In 2015, 39 countries participated in TIMSS, including developed countries from East Asia and the Western world as well as developing countries. The TIMSS achievement scales were established in 1995 based on the combined achievement score distributions across all participating countries. For each discipline – mathematics and science – the scale centerpoint of 500 was set to correspond to the mean of the overall international average achievement score of the distribution, and 100 points on the scale was set to correspond to the standard deviation. Achievement data from subsequent TIMSS assessment cycles were linked to these scales so that increases or decreases in average achievement scores could be monitored across assessments. In order to provide a meaningful description of students' mathematics and science knowledge and proficiency, TIMSS identified four points on the scale for the use as international benchmarks.

Overview of TIMSS Results for Israel

Israel's TIMSS achievement scores have improved over the years. In the present 2015 study, there is no significant change in Israel's average achievement scores in mathematics and science as compared to those of the previous study, TIMSS 2011.

Similar to TIMSS 2011, Israel's average achievement scores are higher than the international average scores of the 39 participating countries. Moreover, the percentages of top-performing (outstanding) students in Israel are among the highest among the participating countries. However, the percentages of low-performing (struggling) students are also relatively high. Furthermore, the dispersion of scores in Israel is one of the largest among the participating countries. These findings are valid for each of the disciplines.

Similar to previous TIMSS cycles, the main achievement gaps arise when comparing students from different sectors: the average achievement score of Hebrew-speaking students is higher than that of Arabic-speaking students, and within each language sector the scores are higher for students with higher socio-economic status.

The full report and additional materials can be found on RAMA's website at:

http://cms.education.gov.il/EducationCMS/Units/Rama/MivchanimBenLeumiym/TIMSS_2015.htm



Main Points

Trends in Israel's Achievement

- Israel's average achievement scores in mathematics and science are **511 points and 507 points, respectively**.
- Compared to **TIMSS 1999** (the **first study** in which Israel participated): **TIMSS 2015 Israel's average achievement scores have shown a large increase both in mathematics (of 45 points) and in science (of 39 points)**.
- Compared to **TIMSS 2011** (the **previous study** in which Israel participated): **in both disciplines there is no significant change in TIMSS 2015 Israel's average achievement scores.**¹

Israel's 2015 Achievement in International Perspective

- Israel's **average achievement scores** in mathematics and science **are higher** than the international average scores of the 39 participating countries. Israel ranks in the **top half** of the ranking of countries according to their students' average achievement scores: **16th and 19th**, respectively, of 39 countries.
- The **percentages of top-performing (outstanding) students** in Israel are **among the highest** among the participating countries. Israel **ranks 8th and 9th** in mathematics and science, respectively, in the ranking of countries according to their percentages of top-performing students. However, the **percentages of low-performing (struggling) students** in Israel are **similar to the international median**. Israel **ranks 20th** in the ranking of countries according to their percentages of low-performing students.
- In both disciplines, the **dispersion of scores** in Israel is **among the largest** among the participating countries.

Israel's 2015 Achievement in Internal Perspective – Achievement Gaps

- **In both disciplines, there are noticeable achievement gaps:**
- **Hebrew-speaking students outperform Arabic-speaking students.** The gaps between Hebrew- and Arabic-speakers average achievement scores are approximately 70 points, in both disciplines.
- **The higher the student's socio-economic status (SES), the higher are the achievement scores.** The gaps between average achievement scores of high and low SES students are approximately 110 points and 130 points, among Hebrew speakers and Arabic speakers, in both disciplines. Achievement gaps between Hebrew- and Arabic-speaking students are much smaller when comparing students from similar SES backgrounds.
- Although there is **no significant difference** between **girls and boys** achievements among **Hebrew speakers**, among **Arabic speakers girls outperform boys**, mainly in **science**.

¹ The decline of 5 points and 9 points in mathematics and science, respectively, was not statistically significant.

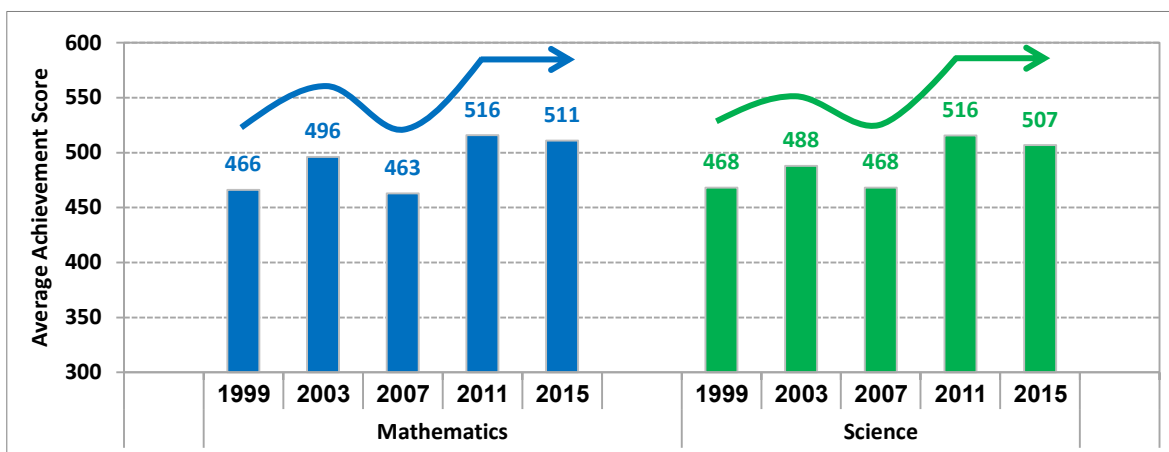
Trends in Israel's Achievement

Israel's average achievement scores in mathematics and science in TIMSS studies have improved across assessment years. Israel's average achievement scores in TIMSS 2015 remained high, basically unchanged compared to the corresponding TIMSS 2011 scores, and continued to reflect major gains as compared to the earlier cycles.

As shown in **Figure 1**, the first four TIMSS cycles are characterized by fluctuations in the average achievement scores in both mathematics and science. Sharp increases in the average achievement scores were obtained between 2007 and 2011, and the high achievement scores were maintained in 2015, although there were non-significant decreases of 5 points and 9 points in mathematics and science, respectively.

Over a decade and a half, since the first participation in TIMSS 1999, there was a large improvement of 45 points in mathematics average achievement scores (from 466 points in 1999 to 511 points in 2015) and of 39 points in mathematics average science scores (from 468 points in 1999 to 507 points in 2015).

Figure 1: TIMSS-average achievement scores of Israeli students in the two disciplines (1999-2015)



When examining the trends in each language sector separately, it comes out that trends among Hebrew-speaking students are similar to those of the general population, whereas trends among Arabic-speaking students are slightly different (**Figures 2 and 3**).

The characteristic fluctuations in the average achievement scores in both disciplines during the first four TIMSS cycles were more moderate among Hebrew speakers, compared to those among Arabic speakers. The 2011 average achievement scores represented the highest TIMSS scores for Israeli students, both in mathematics (536 points and 465 points, respectively) and in science (530 points and 481 points, respectively). Among Hebrew speakers, these high average achievement scores remained almost unchanged in 2015, with only minor non-significant decreases of 3 and 2 points in mathematics and science, respectively. Similarly, among Arabic speakers the high average achievements score in mathematics remained almost unchanged, with only a minor non-significant decrease of 5 points. However, there was a large decrease of 23 points in the average achievement score of Arabic speakers in science.

Figure 2: TIMSS-average achievement scores of Hebrew-speaking students in the two disciplines (1999-2015)

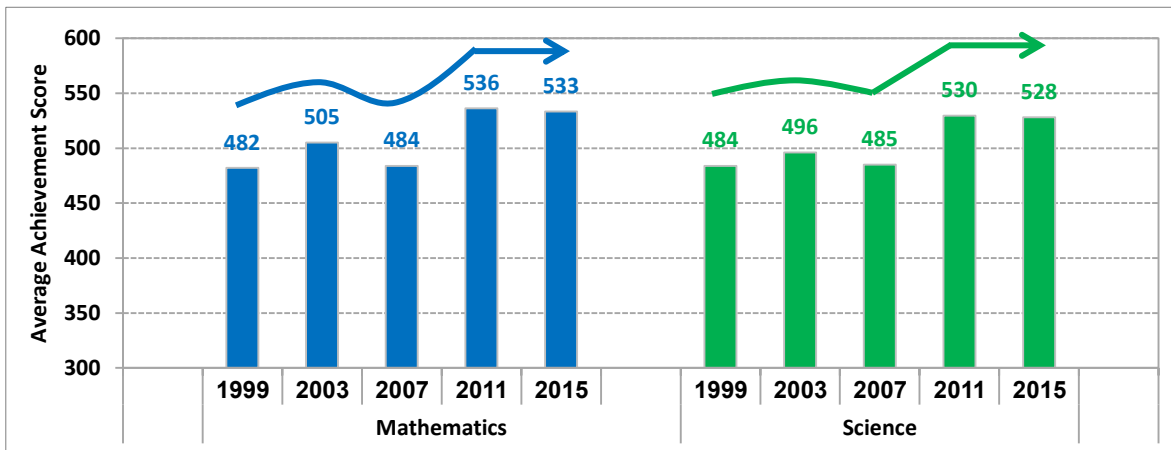
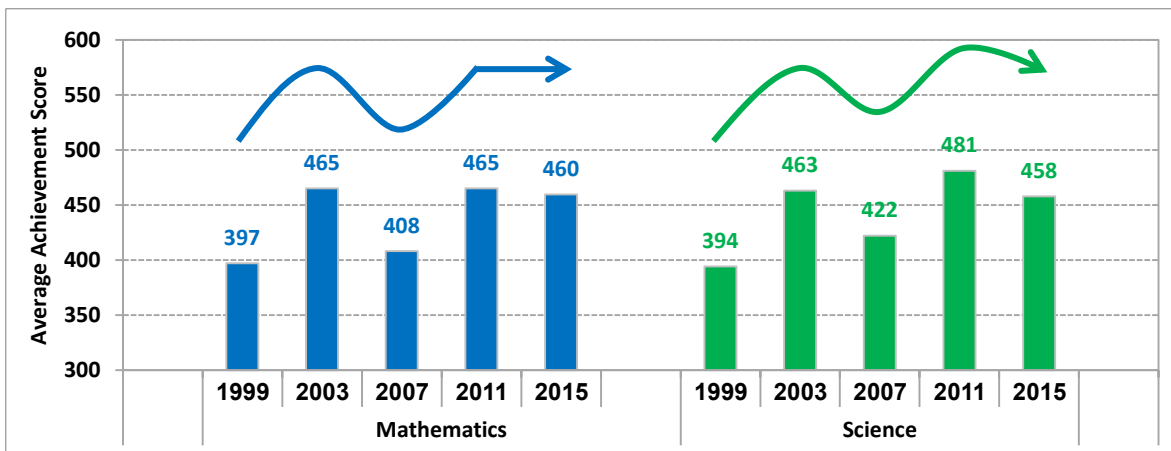


Figure 3: TIMSS-average achievement scores of Arabic-speaking students in the two disciplines (1999-2015)





Analysis of the percentages of top- and low-performing students (outstanding ones who reached advanced benchmark and those who struggle and did not reach the low benchmark, respectively) and in mathematics (**Figure 4**) and science (**Figure 5**) reveals two key findings: first, the percentages of top-performing students in Israel are higher than the international median values in both mathematics (13% in Israel compared to 5% international median) and science (12% and 7%, respectively), while the percentages of low-performing students in Israel are similar to the international median values (of 16%) in both disciplines. Second, there was no real change in the percentages of top- and low-performing students in Israel between 2011 and 2015. In each discipline there was a slight increase (of 1%) in the percentages of top-performing students, and a small increase (of 3%-4%) in the percentages of low-performing students.

When examining the percentages of top- and low-performing students in each language sector separately, it comes out that the percentage of top-performing students in each discipline among Hebrew speakers (15%-16%) is 3 times higher than the corresponding percentage among Arabic speakers (5%-6%). In contrast, the percentage of low-performing students among Hebrew speakers (9%-10%) is 3 times the corresponding percentages among Arabic speakers (30%-31%). Among Hebrew speakers, the percentage of top-performing students in each discipline is higher than international median values, while the percentages of low-performing students are lower than the international median values. In contrast, the percentage of top-performing Arabic speaking students in each discipline is similar to the international median value, while the percentage of low-performing students is twice the international median value.

Compared to TIMSS 2011, it appears that the percentages of top- and low-performing students among Hebrew speakers in each of the disciplines remained basically unchanged (non-significant increases of 1% to 2%). Similarly, the corresponding percentages of top-performing students among Arabic speakers in each of the disciplines also remained basically unchanged (non-significant 1% increase and 2% decrease in mathematics and science, respectively), yet the percentages of low-performing students rose (a slight increase of 3% in mathematics, and a large increase of 7% - from 23% in 2011 to 30% in 2015 – in science).

Figure 4: TIMSS 2015 – trends of the percentages of top- and low-performing students in mathematics in Israel

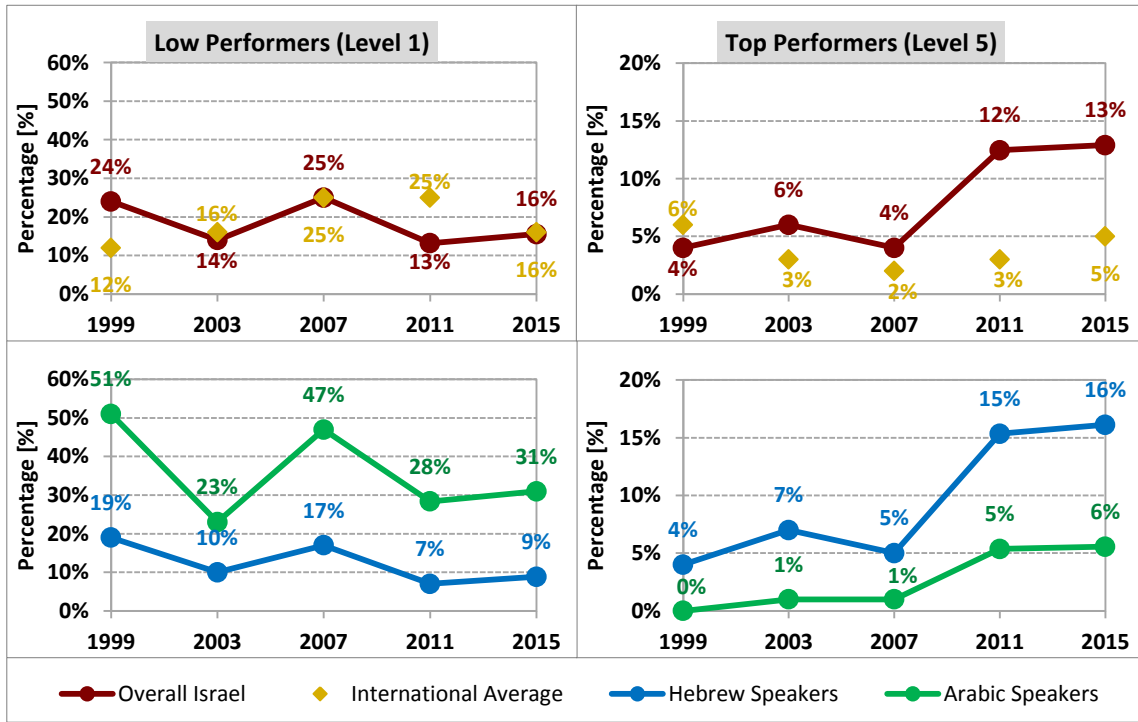
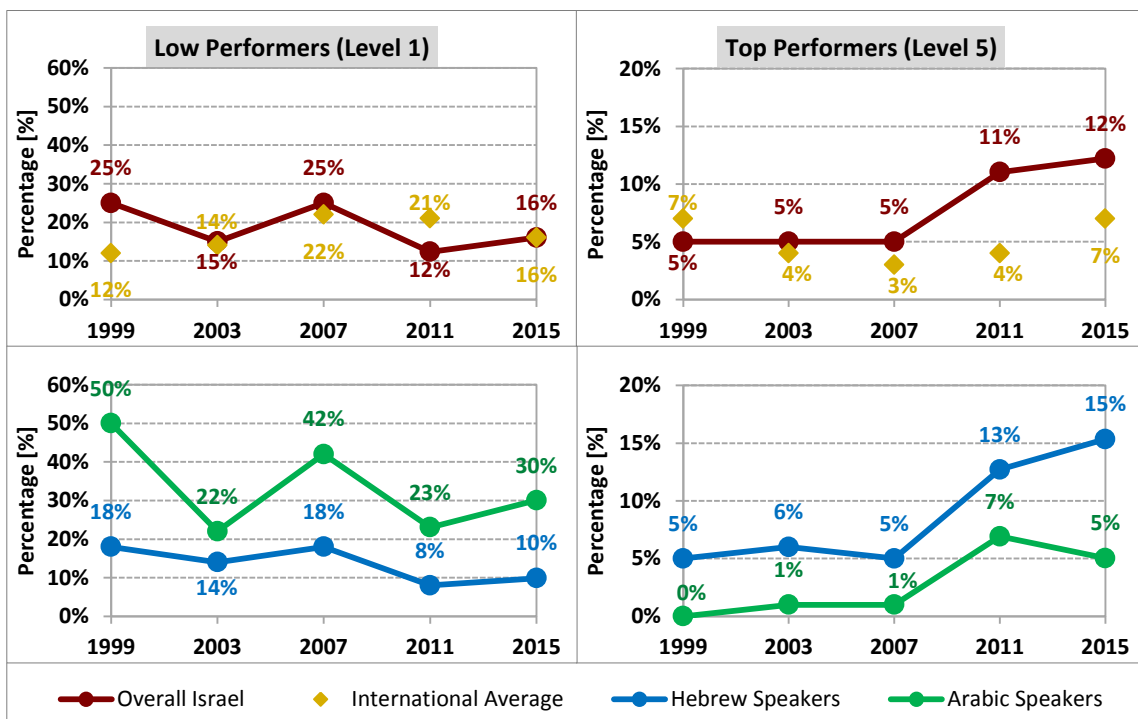


Figure 5: TIMSS 2015 – trends of the percentages of top- and low-performing students in science in Israel





Israel's 2015 Achievement in International Perspective

Israel's average achievement score in each discipline (511 points in mathematics, and 507 points in science) is higher than the international average scores of the 39 participating countries (481 points in mathematics, and 486 points in science).

The overall achievement scores in mathematics and science of the 39 countries that participated in TIMSS 2015 are presented in **Figure 6**. Countries are presented in descending order according to their average achievement score in each discipline. The international average achievement scores are marked in yellow; Israel's average achievement scores are marked in red; and countries whose average achievement scores are not statistically different from that of Israel are marked in pink (also see ranking tables in the Appendix).

Israel is ranked **16th in mathematics** and **19th in science** among the **39 participating countries**. Nevertheless, Israel's average achievement score is not significantly different from the average scores of the countries ranked **10-17 in mathematics** (United States and England - 518 points, Slovenia - 516 points, Hungary - 514 points, Norway - 512 points, Lithuania - 511 points, and Australia - 505 points) and **16-20 in science** (New Zealand - 513 points, Australia - 512 points, Norway - 509 points, and Italy - 499 points).

Israel's rankings in TIMSS 2015 in both mathematics and science are slightly lower compared to its corresponding ranks in the previous study,² even though Israel's average achievement scores remained virtually unchanged. In TIMSS 2011, which included 42 countries, Israel's average achievement scores were not significantly different from the average scores of the countries ranked 7-12 in mathematics (Israel was ranked 7th), and 10-16 in science (Israel was ranked 13th). This is due to several factors:

- The current study, but not the previous one, included countries such as Canada and Ireland, which are known for their relatively high achievement in mathematics and science. These "joining" countries rank in the top third of countries according to their students' average achievement scores. Consequently, Israel and countries with similar achievement scores were "pushed down" in the 2015 rankings.
- Improvements in the 2015 average achievement scores were observed in few countries whose 2011 achievement scores were below (or similar to) Israel's average score, whereas Israel's average scores remained virtually unchanged, as noted before.

² It should be noted that TIMSS is characterized by a relatively high turnover rate for participating countries. Therefore, comparisons across assessment years of countries' rankings according to their achievement scores should be treated with caution.



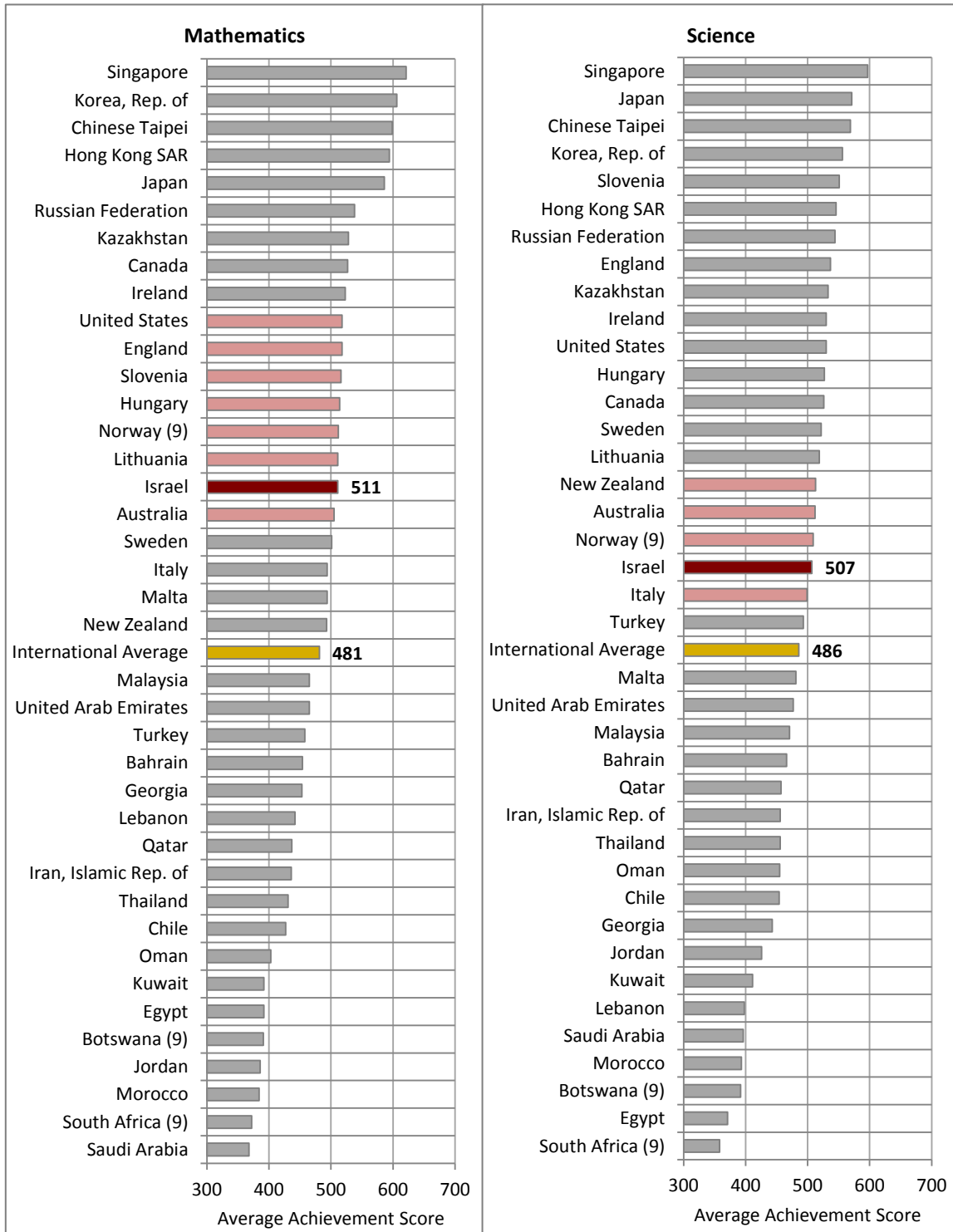
Table 1: A summary of Israeli students' achievement indices in TIMSS 2015 – an international perspective

Discipline	Average Achievement Scores			Percentage of Top-Performing Students			Percentage of Low-Performing Students		
	Israel's average	International average	Israel's rank	Israel	International median	Israel's rank	Israel	International median	Israel's rank
Mathematics	511	481	16 th (10-17) [#]	13%	5%	8 th	16%	16%	20 th
Science	507	486	19 th (16-20) [#]	12%	7%	9 th	16%	16%	20 th

[#] Israel's average achievement score is not significantly different from the average scores of the countries whose ranks are indicated in parentheses



Figure 6: TIMSS 2015 – average achievement scores among the participating countries





The percentages of top-performing students in Israel are among the highest among the participating countries, in both mathematics and science.

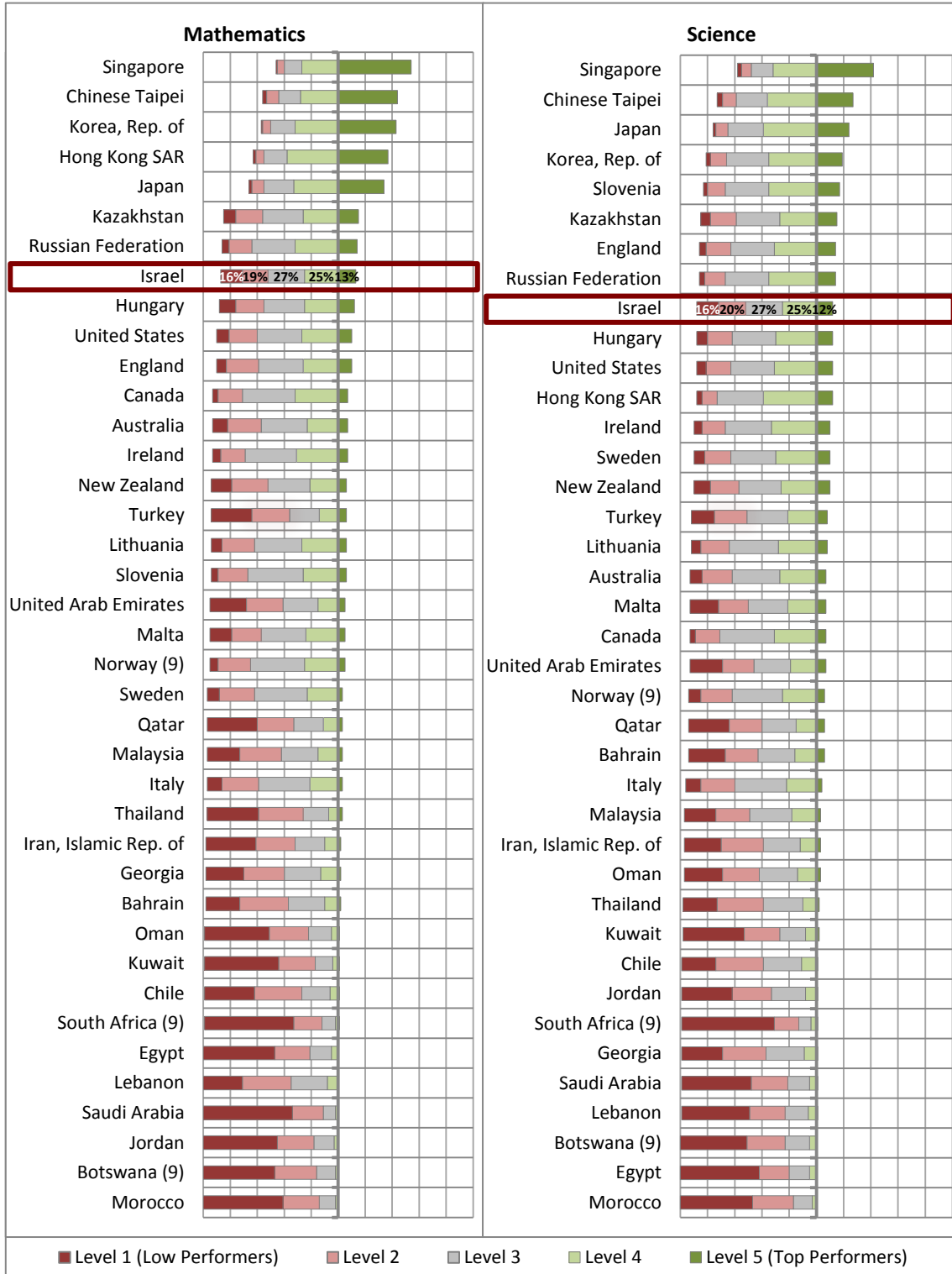
The distribution of scores or performance at the international benchmarks of mathematics and science achievements, among the TIMSS 2015 participating countries, is presented in **Figure 7**. Countries are presented in descending order according to the percentage of top-performing students in each country. The percentages of top-performing students in Israel are 13% in mathematics and 12% in science. Accordingly, Israel ranks 8th and 9th, respectively, in the ranking of countries according to their percentages of top-performing students.

However, **also the percentage of low-performing students in Israel is relatively high**, approximately 16% in each discipline. These percentages are the 1st (in mathematics) and 2nd largest (in science, after Turkey with 17%) among the 21 countries whose average achievement score in a given discipline was above the international average score of all the participating countries.

In Israel, a high correlation between student achievement scores in both disciplines, mathematics and science, was noted (0.89). It means that students who achieved a high score in one discipline, also tended to attain a high score in the other discipline; and students who struggled in one discipline, in most cases also faced many difficulties in the other discipline. Moreover, 8% of Israeli students excelled in both disciplines, while 12% struggled in both disciplines.

The relatively high percentages of top-performing and low-performing students in each discipline indicate a great variation in student achievement and high dispersion of scores.

Figure 7: TIMSS 2015 – distribution of scores (performance) at the international benchmark of mathematics and science achievements among the participating countries





The dispersion of scores in Israel, in each discipline, is very large – among the largest among the participating countries.

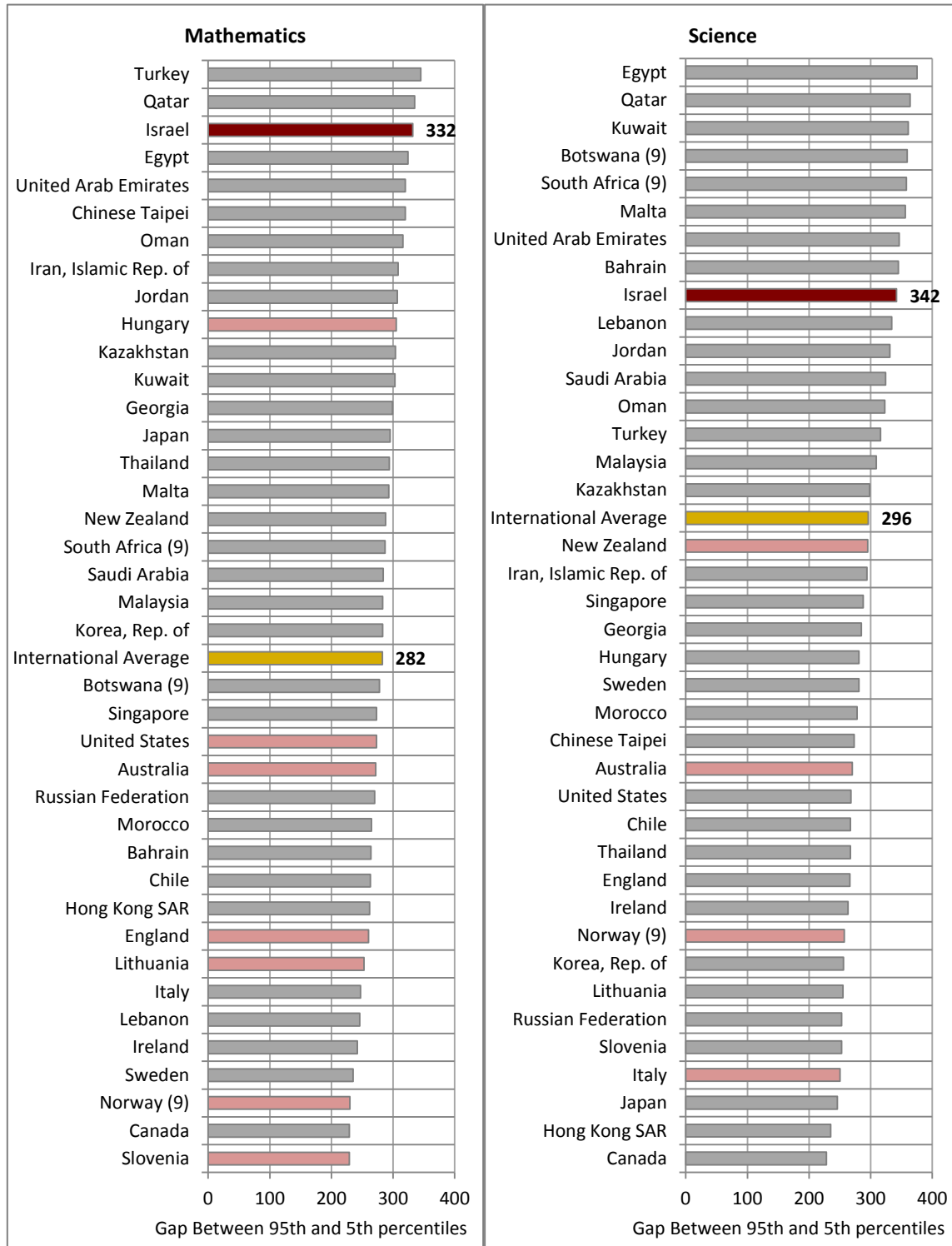
The dispersion of scores among the TIMSS 2015 participating countries is presented in **Figure 8**. Countries are presented in descending order according to the size of the dispersion index. This index measures the gap between the score representing the 95th percentile (score at or above which 5% of the country's strongest students performed), and the score representing the 5th percentile (score at or below which 5% of the country's weakest students performed).

In each of the disciplines, mathematics and science, the dispersion of Israel's scores is among the largest among the participating countries. Israel's dispersion of scores is larger than the international average of the participating countries, and also larger than the dispersion in countries whose average achievement score is similar to that of Israel. Israel's score dispersion is also larger than the score dispersions in the 21 countries whose average achievement scores in a given discipline were above the international average score of all the participating countries.

Israel's dispersion of scores in **mathematics** is **332** points, 50 points higher than the international average of the participating countries. This score dispersion is **third** in size only to the score dispersions of Turkey and Qatar. A **slight increase** of 8 points was observed in Israel's dispersion in mathematics scores, compared to the corresponding score dispersion in TIMSS 2011.

Israel's dispersion of scores in **science** is **342** points, 46 points higher than the international average of the participating countries. This score dispersion is the **ninth-largest** among the 39 participating countries. A **significant increase** of 34 points was observed in Israel's dispersion in science scores, compared to the corresponding dispersion in TIMSS 2011.

Figure 8: TIMSS 2015 – dispersion of scores among the participating countries (gap between the 95th and 5th percentiles)



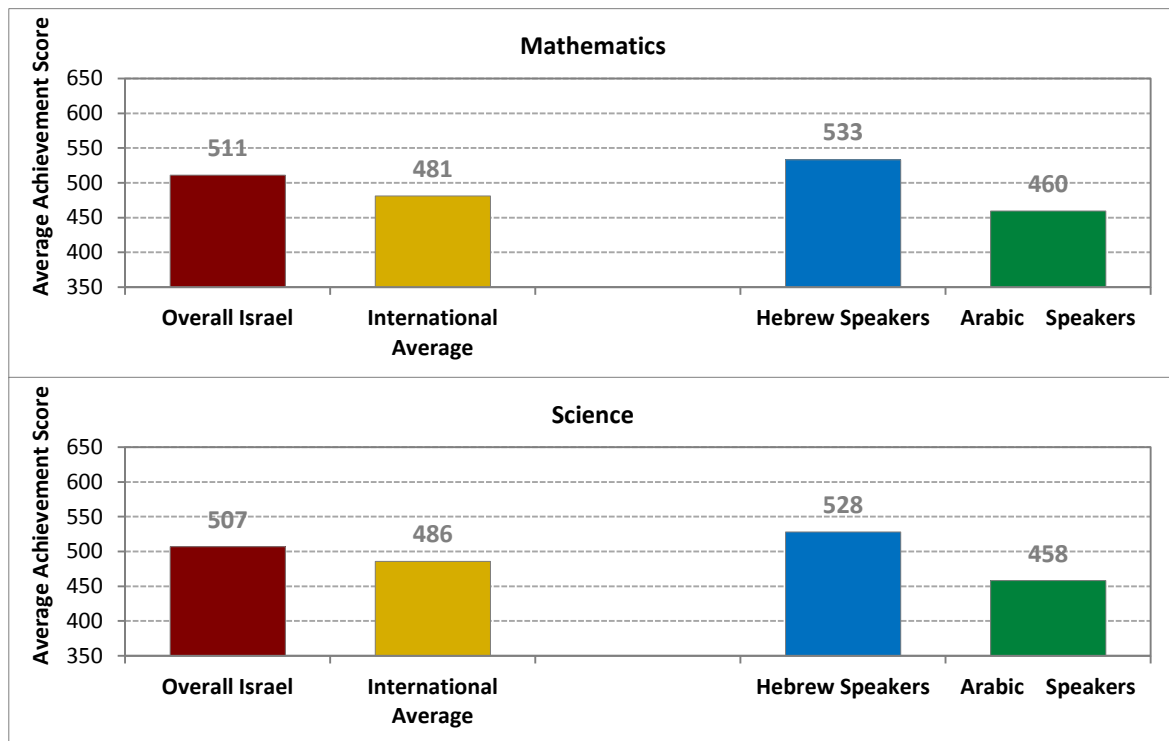
Israel's 2015 Achievement in Internal Perspective – Achievement Gaps

Students' Achievement in Israel, by Language Sector

In both disciplines, the average achievement scores of Hebrew-speaking and Arabic-speaking students are higher and lower, respectively, than the corresponding international average score of the participating countries.

The average achievement scores of Israeli students from each of the language sectors, compared to the overall national and international average scores are presented in **Figure 9**. The **achievement gap** between Hebrew speakers and Arabic speakers stands above **73 points in mathematics** and **70 points in science**. The average achievement scores of Hebrew-speaking students are higher than the international average scores of the participating countries in 52 points in mathematics and 42 points in science. In contrast, these of Arabic-speaking students are lower than the international average scores of the participating countries in 21 points in mathematics and 28 points in science.

Figure 9: TIMSS 2015 – average achievement scores by language sector, compared to overall national and international scores



Consistent with the gap in average achievement scores, as shown in **Figures 4 and 5** above, the percentages of **top-performing Hebrew-speaking students** (about 15% in each discipline) are **much higher** than the corresponding percentages of **top-performing Arabic-speaking students** (about 5%). In addition, the percentages of **low-performing Arabic-speaking students** (about 30% in each discipline) are **much higher** than the corresponding percentages of **low-performing Hebrew-speaking students** (about 10%).

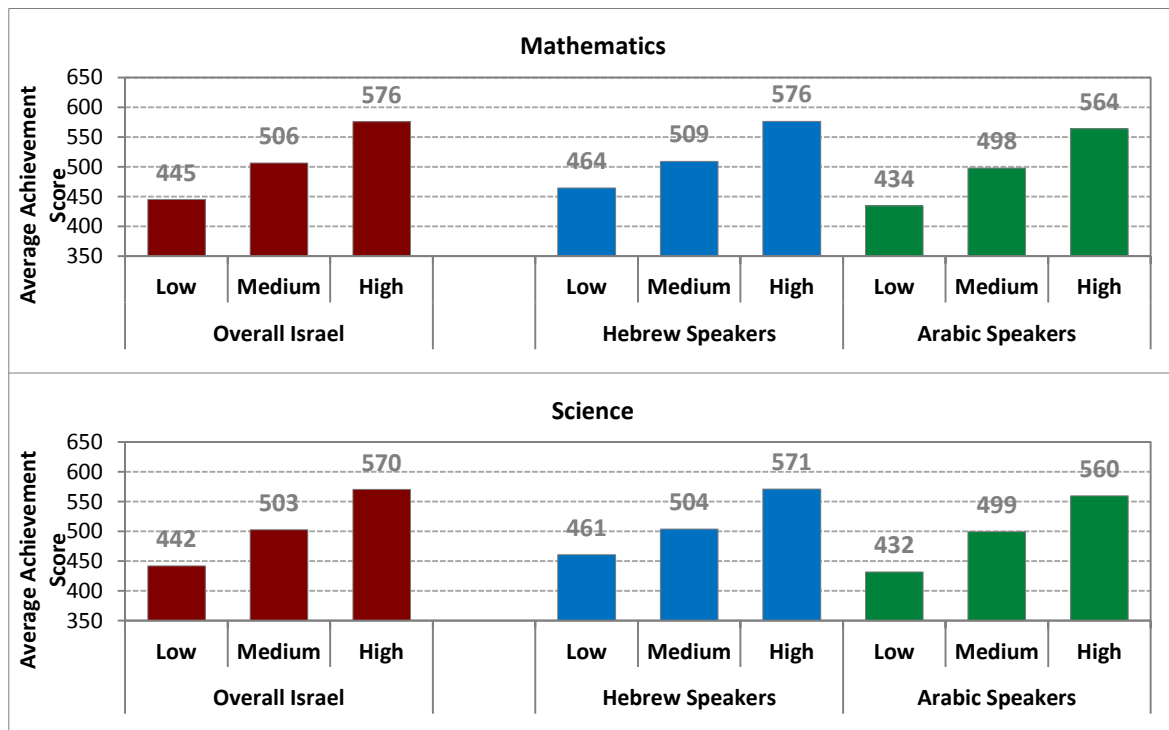
Students' Achievements in Israel by Socio-Economic Status (SES)³

Significant achievement gaps between students from different socio-economic backgrounds were observed: the higher the students' SES, the higher are their achievement scores.

The average achievement scores of Israeli students from each of the language sectors and SES groups are presented in **Figure 10**. Overall in Israel, the **achievement gaps** between high and low SES students stand above **130 points**, in each of the disciplines. Among **Hebrew-speaking students**, in each of the disciplines, the achievement gaps between high and medium SES students (about 65 points) are higher than the achievement gaps between medium and low SES students (about 45 points). The overall **achievement gap** between high and low SES students stands about **110 points** among Hebrew speakers. Among **Arabic-speaking students**, in each of the disciplines, the achievement gaps between high and medium SES students (about 65 points) are similar than the achievement gaps between medium and low SES students. The overall **achievement gap** between high and low SES students stands about **130 points** among Arabic speakers.

Furthermore, when comparing students from the same SES group, the achievement gap between Hebrew- and Arabic-speaking students is considerably smaller, and stands about 10 points or less among high and medium SES students, and about 30 points among low SES students (compared to the 70 points gap in the overall populations).

Figure 10: TIMSS 2015 – average achievement scores by language sector and SES group, compared to national scores



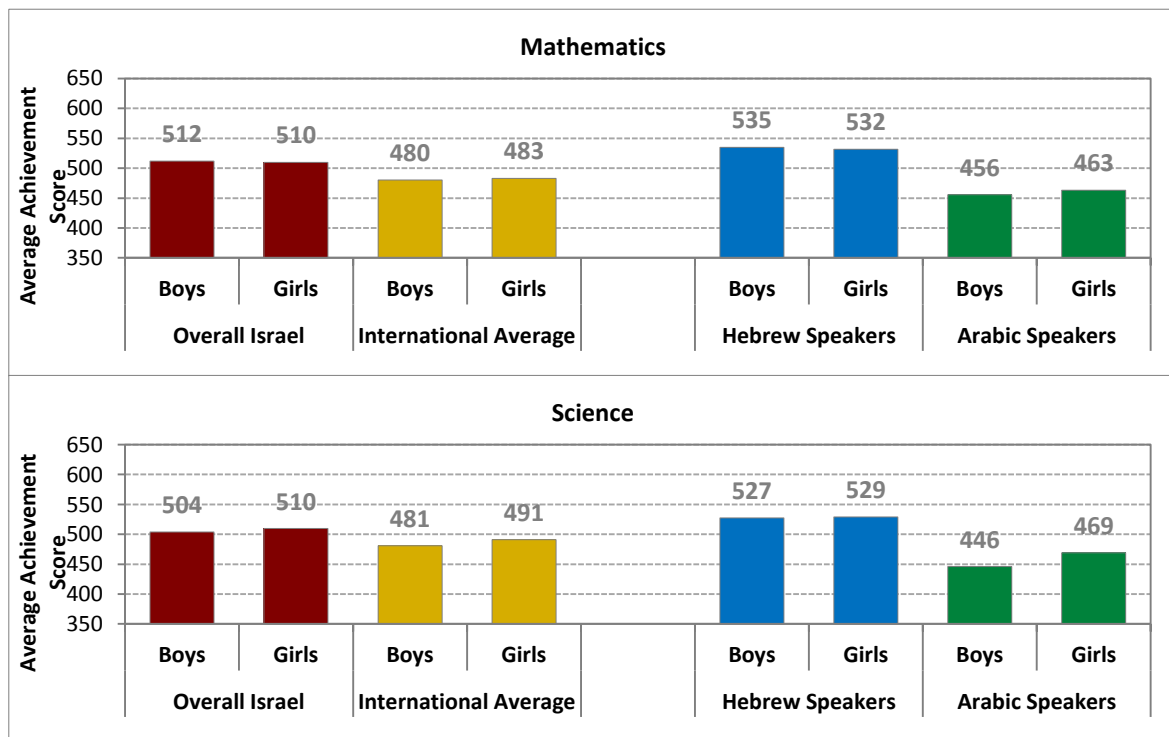
³ The 'Strauss' nurture index was used. It reflects individual's socio-economic background while weighting: parents' education (40%), median income of school parents (20%), peripherality of school (20%), and migration from distressed countries (20%). The index is expressed by nurture deciles representing the decile distribution of all students in schools in the country (from the most based 1st decile, to the weakest 10th decile). For the purpose of analysis and reporting, individuals' nurture index deciles were classified into three groups of students' socio-economic background: High (deciles 1-3); Medium (4-7); Low (8-10).

Students' Achievement in Israel, by Gender

Achievement gaps between boys and girls are only partially similar among Hebrew speakers and Arabic speakers. Achievement gaps, in both disciplines, between boys and girls are very small and non-significant among Hebrew-speakers. An achievement gap in favor of girls is found among Arabic speakers, mainly in science, and to a lesser extent in mathematics.

The average achievement scores of Israeli students from each of the language sectors and gender are presented in **Figure 11**. The more noticeable and significant achievement gap is among Arabic-speaking students, where girls' average score in science is 23 points higher than boys' average score. The corresponding achievement gap in mathematics is much smaller and non-significant, only 7 points, also in favor of girls. Among the Hebrew-speaking students, the average achievement scores of boys and girls are very similar to each other (non-significant gaps, of 3 points in favor of boys in mathematics and of 2 points in favor of girls in science).

Figure 11: TIMSS 2015 – average achievement scores by language sector and gender, compared to overall national and international scores



Appendix: Ranking of Countries According to Their Average Achievement Scores in Mathematics and Science

Mathematics			Science		
Rank	Country	Average score	Rank	Country	Average score
1	Singapore	621	1	Singapore	597
2	Republic of Korea*	606	2	Japan*	571
3	Chinese Taipei (Taiwan)	599	3	Chinese Taipei (Taiwan)	569
4	Hong Kong SAR	594	4	Republic of Korea*	556
5	Japan*	586	5	Slovenia*	551
6	Russian Federation	538	6	Hong Kong SAR	546
	Israel – Hebrew Speakers	533	7	Russian Federation	544
7	Kazakhstan	528	8	England*	537
8	Canada*	527	9	Kazakhstan	533
9	Ireland*	523	10	Ireland*	530
10	United States*	518	11	United States*	530
11	England*	518		Israel – Hebrew Speakers	528
12	Slovenia*	516	12	Hungary*	527
13	Hungary*	514	13	Canada*	526
14	Norway (9)*	512	14	Sweden*	522
15	Lithuania	511	15	Lithuania	519
16	Israel*	511	16	New Zealand*	513
17	Australia*	505	17	Australia*	512
18	Sweden*	501	18	Norway (9)*	509
19	Italy*	494	19	Israel*	507
20	Malta	494	20	Italy*	499
21	New Zealand*	493	21	Turkey*	493
22	Malaysia	465	22	Malta	481
23	United Arab Emirates	465	23	United Arab Emirates	477
	Israel – Arabic Speakers	460	24	Malaysia	471
24	Turkey*	458	25	Bahrain	466
25	Bahrain	454		Israel – Arabic Speakers	458
26	Georgia	453	26	Qatar	457
27	Lebanon	442	27	Islamic Republic of Iran	456
28	Qatar	437	28	Thailand	456
29	Islamic Republic of Iran	436	29	Oman	455
30	Thailand	431	30	Chile*	454
31	Chile*	427	31	Georgia	443
32	Oman	403	32	Jordan	426
33	Kuwait	392	33	Kuwait	411
34	Egypt	392	34	Lebanon	398
35	Botswana (9)	391	35	Saudi Arabia	396
36	Jordan	386	36	Morocco	393
37	Morocco	384	37	Botswana (9)	392
38	South Africa (9)	372	38	Egypt	371
39	Saudi Arabia	368	39	South Africa (9)	358

* Member countries in The Organisation for Economic Co-operation and Development (OECD)

(9) Countries in which the TIMSS 2015 8th-grade assessment was administrated to 9th-grade students