Challenge for Japanese School Education to Achieve Small Class Sizes

– An International Comparative Empirical Validation Using Micro- and Macrodata –

Research team for small class sizes
Institute for Global Education and Culture

Summary of the Survey and its Objectives

This report presents the results from empirical analyses of international comparative micro- and macrodata to bring further understanding on school education in Japan and towards the realization of small class sizes. In Chapter 1, data from "*Education at a Glance*", an international comparative report on education published by OECD, are used as macrodata for an international comparative assessment of educational expenditures and student-to-teacher ratio (ST ratio), as well as to summarise the issues that school education in Japan is facing. A particular focus is set on the "theoretical class size", an indicator used in *Education at a Glance* to comprehend ST ratio.

In Chapter 2, we calculate the theoretical class size from the TALIS 2018 international comparative microdata to assess the relationship of the indicator with teacher stress as well as with other factors and to demonstrate empirically the effectiveness of implementing small classes in Japan.

1. International Comparison from *Education at a Glance* 2020

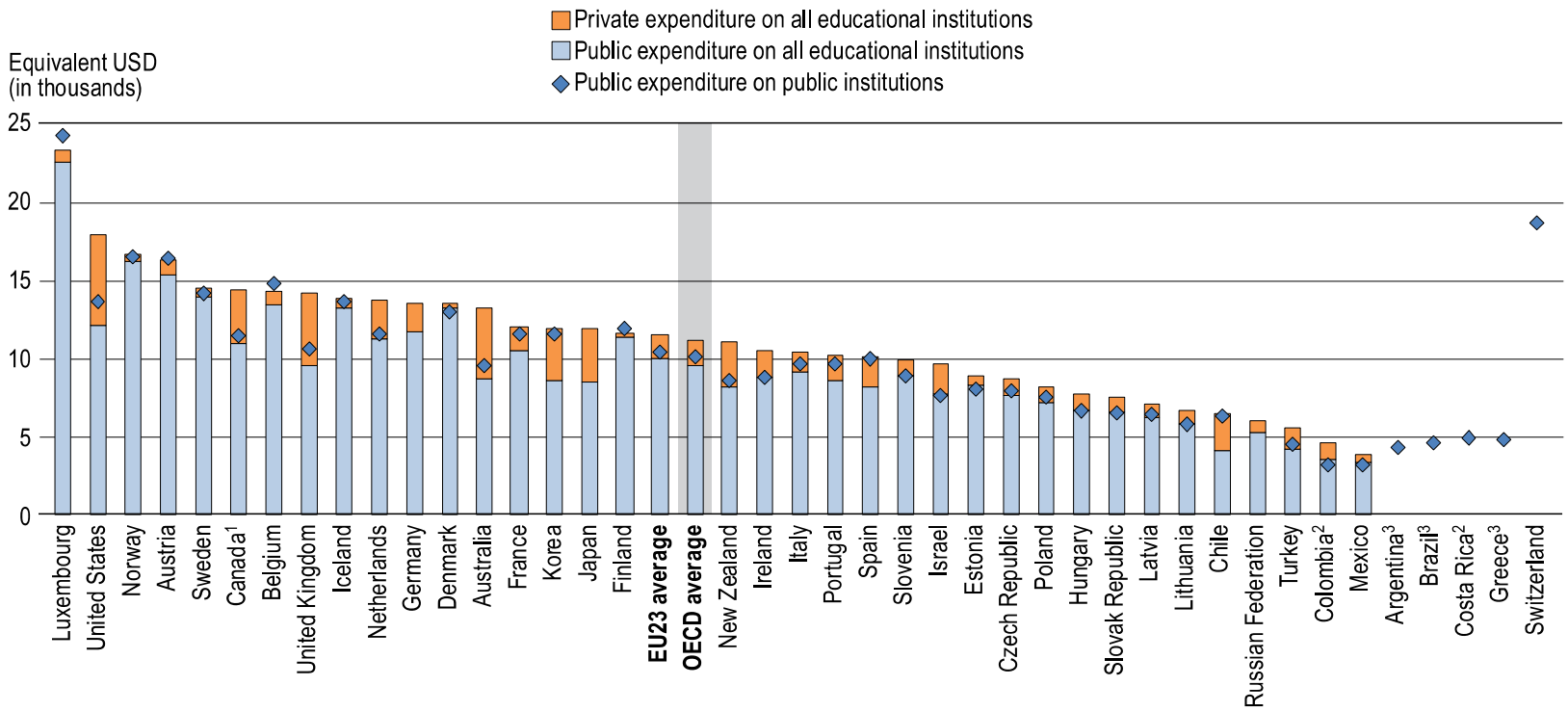
1.1. Educational expenditure per student

First, data from *Education at a Glance* are used for clarifying the challenges school education in Japan faces. Figure 1 shows the per student expenditure on education. While Japan is often pointed out as one of the countries with the lowest educational expenditure in terms of percentage GDP, the per student expenditure ranks slightly above the OECD average: The phenomenon is attributable to the country's demographic composition, with a relatively low number of children due to the low birth rate of an ageing society, resulting in a higher rank of educational expenditure per student than that of percentage GDP.

Despite the above, Table 1 shows that the ranking of expenditure on education per student by educational institution varies according to the level of education. The values for the primary education (column 1 in the table) and that for the lower secondary education (column 2 in the table) show that Japan's educational expenditure is lower than the OECD average. It suggests that the lack of educational expenditure at the early education stage is an issue we need to address.

Figure 1. Total expenditure on educational institutions per full-time equivalent student, by source of funds (2017)

From primary to tertiary education, in equivalent USD converted using PPPs, direct expenditure within educational institutions (final source of funds).



Note: International expenditure is aggregated with public expenditure for display purposes.

1. Primary education includes pre-primary programmes.
2. Year of reference 2018.
3. Data only available for government expenditure on public educational institutions.

Countries are ranked in descending order of total expenditure on educational institutions per full-time equivalent student.

Source: OECD/UIS/Eurostat (2020), Table C1.5 and C1.6 (web tables). See *Source* section for more information and Annex 3 for notes (https://doi.org/10.1787/69096873-en).

Adapted from: OECD Education at a Glance 2020, p270.

Table 1. Total expenditure on educational institutions per full-time equivalent student (2017)

In equivalent USD converted using PPPs for GDP, direct expenditure within educational institutions, by level of education.

		Secondary							Tertiary					
			Upper secondary											
	Primary	Lower secondary	General programmes	Vocational programmes	All programmes	All secondary	Post-secondary non-tertiary	Primary, secondary and post-secondary non-tertiary	Short-cycle tertiary	Long-cycle tertiary	All tertiary	All tertiary (excluding R&D)	Primary to tertiary	Primary to tertiary (excluding R&D)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
OECD Countries														
Australia	10 238	13 181	14 019	7 371	11 825	12 640	8 504	11 270	10 943	23 261	20 436	14 314	13 272	11 935
Austria	12 754	16 794	14 425	18 054	16 593	16 705	5 700	15 097	18 457	19 206	19 089	13 711	16 319	14 672
Belgium	11 106	14 524	14 210 d	14 896 d	14 606 d	14 578 d	x(3, 4, 5, 6)	13 054	12 965	19 649	19 422	12 539	14 287	12 954
Canada[1, 2]	10 238 d	x(1)	x(5)	x(5)	13 891	13 891	m	11 380 d	18 820	27 948	24 671	m	14 428 d	m
Chile	5 259	5 440	4 393	8 342	5 033	5 167	a	5 213	4 821	11 503	9 610	9 079	6 487	6 333
Colombia[2, 3]	3 494	4 468	x(5)	x(5)	3 436	4 177	m	3 855	x(11)	x(11)	2 335	1 331	3 538	3 328
Costa Rica[3]	m	m	m	m	m	m	a	m	m	m	m	m	m	m
Czech Republic	5 971	10 081	8 174	9 645	9 246	9 666	2 763	8 052	18 866	11 462	11 484	7 217	8 732	7 887
Denmark	13 278	13 127	x(5)	x(5)	9 526	11 164	a	12 163	17 623	18 116	18 062	8 778	13 499	11 396
Estonia	7 481	7 622	6 878	7 670	7 208	7 404	8 053	7 462	a	14 580	14 580	9 618	8 946	7 912
Finland	9 633	15 400	8 719	7 985 d	8 180 d	10 454 d	x(4, 5, 6)	10 133	a	17 730	17 730	9 874	11 637	10 082
France	8 319	11 252	13 944	16 227	14 743	12 748	9 897	10 867	15 359	17 442	16 952	11 638	12 080	11 020
Germany	9 572	11 975	12 963	17 960	15 466	13 283	12 403	12 195	11 284	18 487	18 486	10 436	13 529	11 822
Greece	6 085	6 951	5 834	8 756	6 638	6 789	m	m	a	3 294	3 294	2 137	m	m
Hungary	5 491	5 259	7 961	9 494	8 465	6 867	13 642	6 780	4 675	13 256	12 878	10 838	7 797	7 457
Iceland	13 333	15 620	10 785	13 426	11 503	13 122	15 532	13 254	9 682	16 497	16 270	m	13 819	m
Ireland	8 215	10 054	x(5)	x(5)	8 890	9 445	35 312	9 218	x(11)	x(11)	16 794	16 185	10 489	10 386
Israel	9 155	x(3, 4, 5)	6 940 d	17 258 d	9 079 d	9 079	1 205	9 064	5 584	15 795	12 310	8 382	9 671	8 936
Italy	9 160	10 073	x(5)	x(5)	10 883 d	10 574 d	x(5, 6)	10 036	4 240	12 277	12 226	8 131	10 473	9 655
Japan	8 824	10 511	x(5)	x(5)	11 510 d	11 024 d	x(5, 6, 9, 10, 11)	9 963	13 617 d	20 209 d	18 839 d	m	11 896	m
Korea	11 702	12 597	x(5)	x(5)	14 394	13 579	a	12 704	5 791	11 948	10 633	8 400	11 981	11 202
Latvia	6 379	6 492	7 048	8 628	7 680	7 102	8 585	6 766	8 141	8 381	8 346	6 379	7 121	6 679
Lithuania	6 340	5 994	6 066	5 832	6 002	5 997	5 857	6 094	a	8 428	8 428	6 353	6 652	6 156
Luxembourg	19 690	23 073	22 236	22 546	22 427	22 724	1 951	21 244	27 920	55 433	52 089	32 325	23 324	22 053
Mexico	2 782	2 438	3 115	3 980	3 418	2 823	a	2 803	x(11)	x(11)	6 586	5 263	3 320	3 139
Netherlands	9 301	13 527	11 365	15 776	14 274	13 889	a	11 931	11 467	20 493	20 445	13 104	13 809	12 190
New Zealand	8 533	10 059	12 004	13 859	12 401	11 117	10 059	9 937	11 279	17 096	16 068	12 755	11 098	10 471
Norway	13 906	13 906	17 398	16 982	17 191	15 735	21 168	14 848	20 615	23 522	23 439	13 414	16 644	14 548
Poland	7 806	7 286	6 798	8 639	7 838	7 577	3 742	7 597	27 938	10 041	10 044	7 843	8 144	7 652
Portugal	8 766	10 993	x(5)	x(5)	10 463 d	10 721 d	x(5, 6)	9 836	7 451	11 941	11 788	9 126	10 220	9 696
Slovak Republic	6 836	6 121	7 217	7 441	7 370	6 652	6 383	6 711	8 345	11 776	11 715	9 075	7 562	7 113
Slovenia	9 062	11 336	9 199	7 599	8 110	9 370	a	9 223	3 757	14 100	12 787	10 302	9 897	9 427
Spain	8 161	9 567	9 732	12 851 d	10 711 d	10 134 d	x(4, 5, 6)	9 166	9 795	14 387	13 446	10 052	10 105	9 360
Sweden	12 189	12 894	11 078	14 723	12 427	12 634	5 883	12 339	6 874	27 167	25 584	11 928	14 505	12 271
Switzerland	m	m	x(5)	x(5)	18 966 d	m	x(5)	m	m	m	m	m	m	m
Turkey	4 002	3 912	5 448	6 159	5 776	4 859	a	4 594	x(11)	x(11)	9 708	7 857	5 586	5 227
United Kingdom	11 604	11 749	13 429	8 978	11 480	11 592	a	11 597	19 093	29 131	28 144	22 291	14 209	13 285
United States	12 592	13 654	x(5)	x(5)	15 202	14 411	15 908	13 511	x(11)	x(11)	33 063	29 153	17 993	17 096
OECD average	9 090	10 527	10 051	11 521	10 888	10 547	m	9 999	12 422	17 566	16 327	11 234	11 231	10 104
EU23 average	9 269	10 963	10 383	11 774	10 836	10 786	m	10 344	13 014	17 126	16 688	11 339	11 515	10 506
Partners														
Argentina	m	m	m	a	m	m	a	m	m	m	m	m	m	m
Brazil	m	m	m	m	m	m	m	m	m	m	m	m	m	m
China	m	m	m	m	m	m	m	m	m	m	m	m	m	m
India	m	m	m	m	m	m	m	m	m	m	m	m	m	m
Indonesia[3]	m	m	m	m	m	m	a	m	m	m	m	m	m	m
Russian Federation	x(3, 4, 5, 6)	x(3, 4, 5, 6)	5 651 d	2 582 d	5 382 d	5 382 d	x(3, 4, 5, 6)	5 382	5 379	9 776	8 629	7 750	6 090	5 898
Saudi Arabia	m	m	m	m	m	m	m	m	m	m	m	m	m	m
South Africa	m	m	m	m	m	m	m	m	m	m	m	m	m	m
G20 average	m	m	m	m	m	m	m	m	m	m	m	m	m	m

Note: See *Definitions* and *Methodology* sections for more information. Data and more breakdowns available at http://stats.oecd.org/, Education at a Glance Database.

1. Primary education includes pre-primary programmes.
2. Post-secondary non-tertiary figures are treated as negligible.
3. Year of reference 2018.

Source: OECD/UIS/Eurostat (2020). See *Source* section for more information and Annex 3 for notes (https://doi.org/10.1787/69096873-en).

Please refer to the Reader's Guide for information concerning symbols for missing data and abbreviations.

Adapted from: OECD Education at a Glance 2020, p280.

1. 2. Changes in government spending on education

Figure 2 shows the changes in government expenditure and educational expenditure between 2012 and 2017, with 2012 as reference year (index 100). Such indicators are useful to see the extent to which countries have placed (or not have placed) emphasis on education spending, since an increase in education spending in particular country may simply be the result of an increased overall government spending. On the other hand, a decrease in education spending might have been caused by a decreased overall government spending. Hence, the ratio between the change in educational expenditure and the change in overall government expenditure allows to capture changes in the relative importance of educational expenditure.

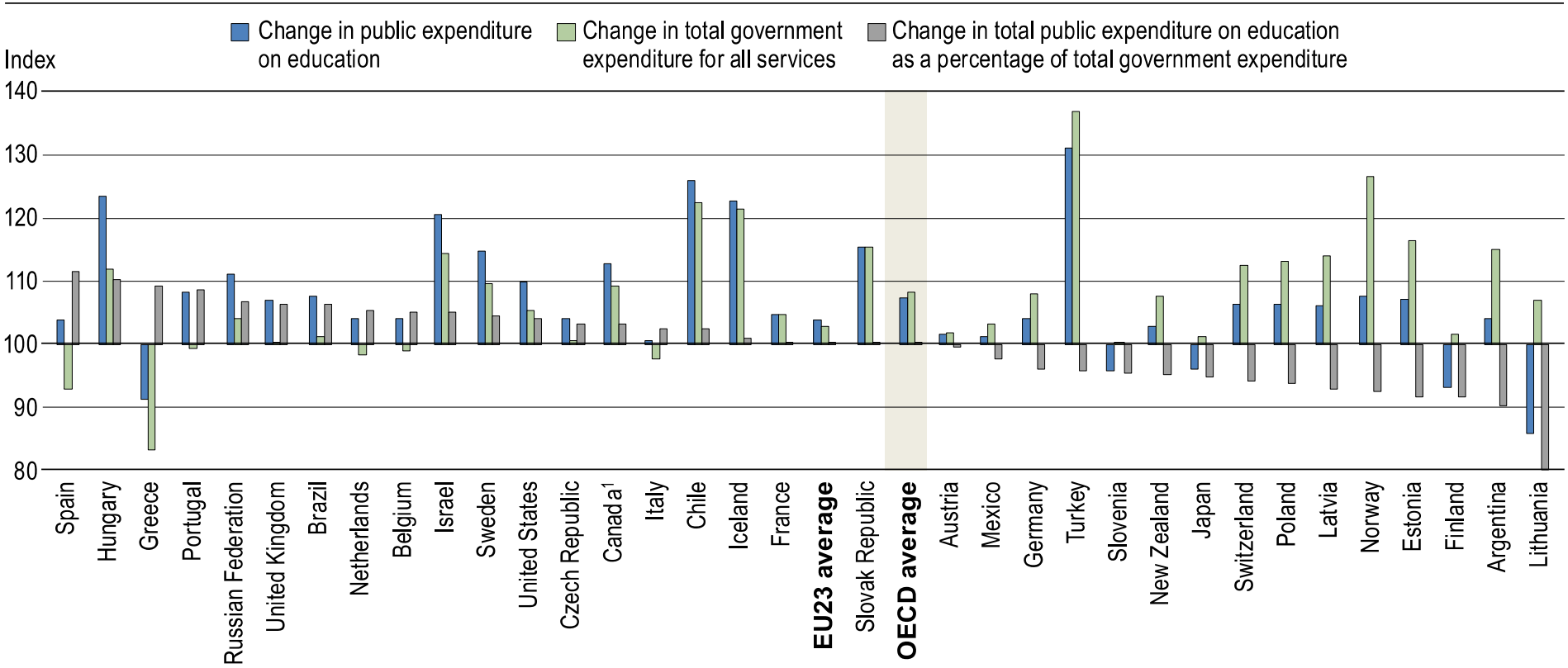
The indicators in Figure 2 show the followings:

- Blue bars: The expenditure on education increased from 2012 when the value exceeds 100.
- Green bars: The overall government expenditure increased from 2012 when the value exceeds 100.
- Grey bars: The overall-to-educational expenditures (in percentage) increased when the value exceeds 100.

Examining changes that have occurred in Japan in the light of the above indicates that, while the overall government expenditure (in green) increased, the expenditure on education decreased (in blue). This resulted in a decreased percentage allocated to education in the total government expenditure which is below the OECD average.

Figure 2. Index of change in total public expenditure on education as a share of total government expenditure (2012 and 2017)

Primary to tertiary education (2012 = 100); 2015 constant prices.



1. Primary education includes pre-primary programmes.

Countries are ranked in descending order of the change in total public expenditure on education as a percentage of total government expenditure.

Source: OECD/UIS/Eurostat (2020), Table C4.3. See *Source* section for more information and Annex 3 for notes (https://doi.org/10.1787/69096873-en).

Adapted from: OECD Education at a Glance 2020, p312.

1. 3. Decomposition to factors determining teachers' salaries

Figure 3 shows the impact of each factor on the per-student teacher's salary. For example, the graph reveals that, given the same salary, longer teaching hours allow to teach more students while reducing the teachers' per-student salary level. On the vertical axis, a power parity (PPP)-converted US dollars (USD) for a given factor exceeding 0 indicates that it lowers the teacher's salary, whereas a negative value indicates it increases the teacher's salary. Furthermore, decomposed to the index discloses four factors impacting teachers' salaries, which are:

- Contribution of teachers' salary
- Contribution of instruction time
- Contribution of teaching time
- Contribution of theoretical class size.

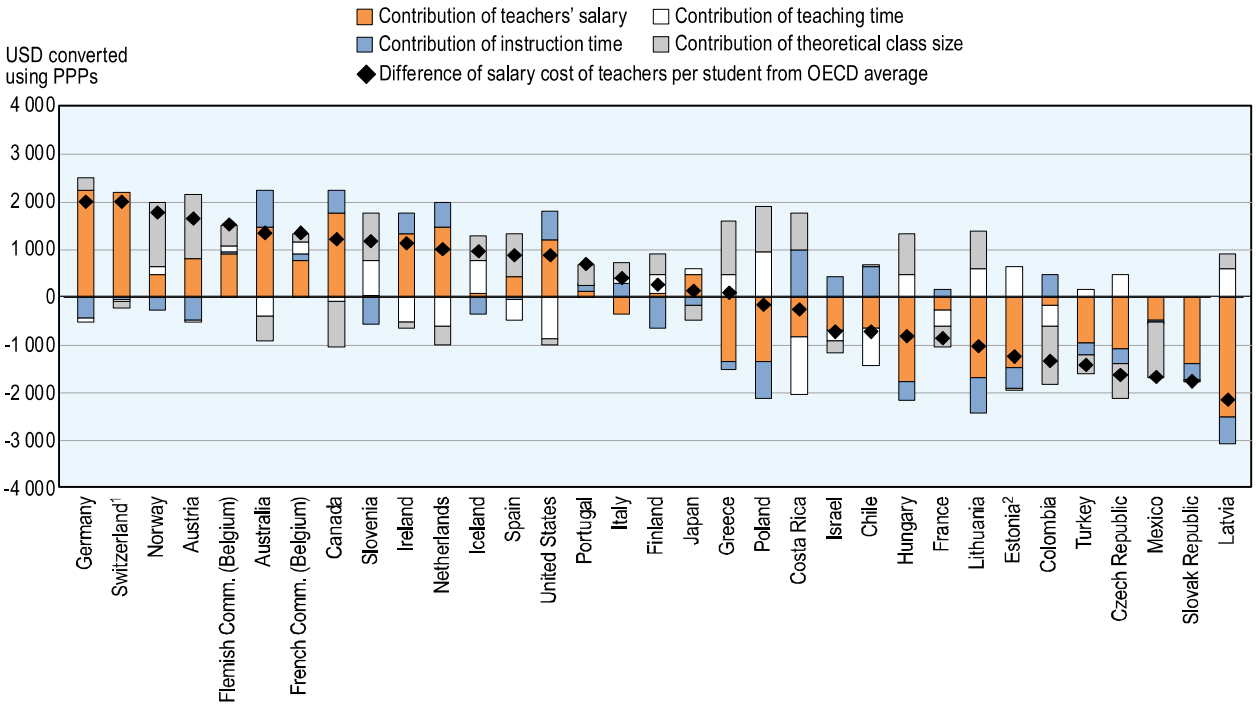
Of these four factors, the theoretical class size not only represents the teacher's feeling of burden as calculated from the regular teaching hours, but also from the time spent in extra tasks. For example, a timetable whereby a teacher spends 15 hours a week to teach thirty (30) students, any additional hours spent in extra tasks would increase the workload. Hence, making a teacher teach more students results in a *de facto* reduction of salary (more on this in the next paragraphs).

Bearing the above in mind, the salary cost of teachers per student in Japan slightly exceeds the OECD average. The graph shows that, for Japan, the instruction time and the theoretical class size are below the zero (0) line, indicating that they are longer than the OECD average, hence "reduces" the teacher's per-student salary. On the other hand, the number of teaching hours extends above zero line, showing that teachers in Japan less time teaching in class than the OECD average, becoming a factor that "raises" their per-student salary.

Therefore, the long instruction time and the large theoretical class size result in a low per-student salary for teachers, which is a characteristic to Japan as compared with other countries. The next section focusses on the theoretical class size to examine its relationship with stress scores and other factors by using microdata from the TALIS survey.

Figure 3. Contribution of various factors to salary cost of teachers per student in public institutions, primary education (2018)

USD converted using PPPs for private consumption



How to read this figure: This figure shows the contribution (in USD) of the factors influencing the difference between salary cost of teachers per student in the country and the OECD average. For example, in Poland, the salary cost of teachers per student is USD 192 lower than the OECD average. Poland has a smaller theoretical class size (+ USD 975) and less teaching time (+ USD 953) than the OECD average, both of which push the salary cost of teachers up. However, this is more than compensated for by below-average teachers' salaries (- USD 1 357) and below-average instruction time (- USD 762), which push the cost down.

Notes: See Table D2.5, available on line, for notes on each factor.

1. Teachers' statutory salaries after 10 years of experience instead of 15 years.
2. Teachers' statutory salaries at the start of their career instead of after 15 years of experience.

Countries and economies are ranked in descending order of the difference between the salary cost of teachers per student and the OECD average.

Source: OECD (2020), Table D2.4, available on line. See *Source* section for more information and Annex 3 for notes (https://doi.org/10.1787/69096873-en).

Adapted From: OECD Education at a Glance 2020, p377.

2. Class size and teacher's feeling of burden

2.1 Estimating theoretical class sizes

The actual situation of class size in Japan is estimated using the theoretical class size introduced in the previous section. First, the theoretical class size is calculated with the following formula:

$$\frac{instruction\ time}{Teaching\ time} \times \frac{Number\ of\ students}{Number\ of\ teachers}$$

whereby the number of students per teacher of the right term is the nominal ST ratio, which is often used as a measure of the number of students per teacher. The theoretical class size, in turn, is the product of the nominal ST ratio with instruction-to-teaching time ratio.

Generally, the work of a schoolteacher is not limited to teaching but includes preparation for classes, extra-curricular activities and other peripheral tasks. When the time exceeds the time spent on teaching in class, the teacher (and the school) can be considered to be taking care of more students than the simple number of headcounts may show. Therefore, the theoretical class size can be regarded as a measure of the workload of a teacher that takes into consideration the instruction time outside of the regular teaching time. When the teaching time equals the time taught in class, the value matches the nominal ST ratio, but when the time spent in extra tasks is longer than the teaching time, it will exceed the nominal ST ratio.

According to *Education at a Glance 2020,* the theoretical class size of primary schools in Japan is 16.71, slightly higher than the OECD average, 14.94. The extra task time and the teaching time of primary school teachers are roughly the same, with a ratio of approximately 1, and with no significant gap between the nominal ST ratio and the theoretical class size.

As regards the theoretical class size for lower secondary school teachers, the OECD report does not provide such data. Therefore, in this section, we use the data from another survey conducted by OECD, namely the International Survey of Teacher Instructional Environments (TALIS) to estimate the theoretical class sizes in junior high school in Japan.

The series of variables used to estimate are as follows:

First, we calculate the teaching time and the instruction time for each teacher in the data set by the answers to the following two questions in the TALIS teacher questionnaire. Then we get their school average. The questions were:

- "*Of this total, how many 60-minute hours did you spend on teaching at this school during your most recent complete calendar week?*" and
- "*Approximately how many 60-minute hours did you spend on the following tasks during your most recent complete calendar week, in your job at this school?*".

The instruction time included time spent in tasks such as teaching preparation, extracurricular activities, or any tasks other than teaching in classroom. Data with cumulative working hours exceeding 24 hours were deleted case wise.

Then, the nominal ST ratio of each school was obtained using the TALIS Principal questionnaire data. A school's theoretical class size was obtained by calculating the products of the ratios as mentioned in the formula above.

Subsequently, country theoretical class sizes were estimated by the arithmetic mean of all participating schools of a country.

Figure 4 compares the nominal ST ratios with the theoretical class sizes calculated from TALIS data (note that the countries participating in the TALIS survey differ from those in *Education at a Glance*). The blue bars show the nominal ST ratio and the green bars the theoretical class size. The values next to these bars are the ratio between the theoretical class size and the nominal ST ratio. These values also indicate the amount of time a teacher spends in extra tasks relative to one hour spent teaching in class. A nominal ST ratio tends to be smaller than the actual number of students per teacher since the denominator includes teaching staff other than homeroom teachers. The value for 2018 is below 15 while the theoretical class size exceeds 35[1].

As to the country averages, only Finland displays a theoretical class size smaller than the nominal ST ratio. It is also the only country where the instruction time is shorter than the teaching time.

Japan has a theoretical class size of 35.2 which figures among the countries with the largest values, reaching as high as 2.5 times the nominal ST ratio. This indicates that teachers spend very long hours in extra tasks. Taiwan and Kazakhstan are the only countries with theoretical class sizes and nominal ST ratios larger than Japan.[1]

[1] Note that the TALIS data were collected before the Act on Standards for Class Formation and Fixed Number of School Personnel of Public Compulsory Education Schools (Law number: Act No. 116 of 1958) has entered into force. The amendment makes class size of elementary schools smaller gradually to 35 in 5 years.

Figure 4. International Comparison of Theoretical Class Size
(Plotted from TALIS 2018 data by Hamamoto S)

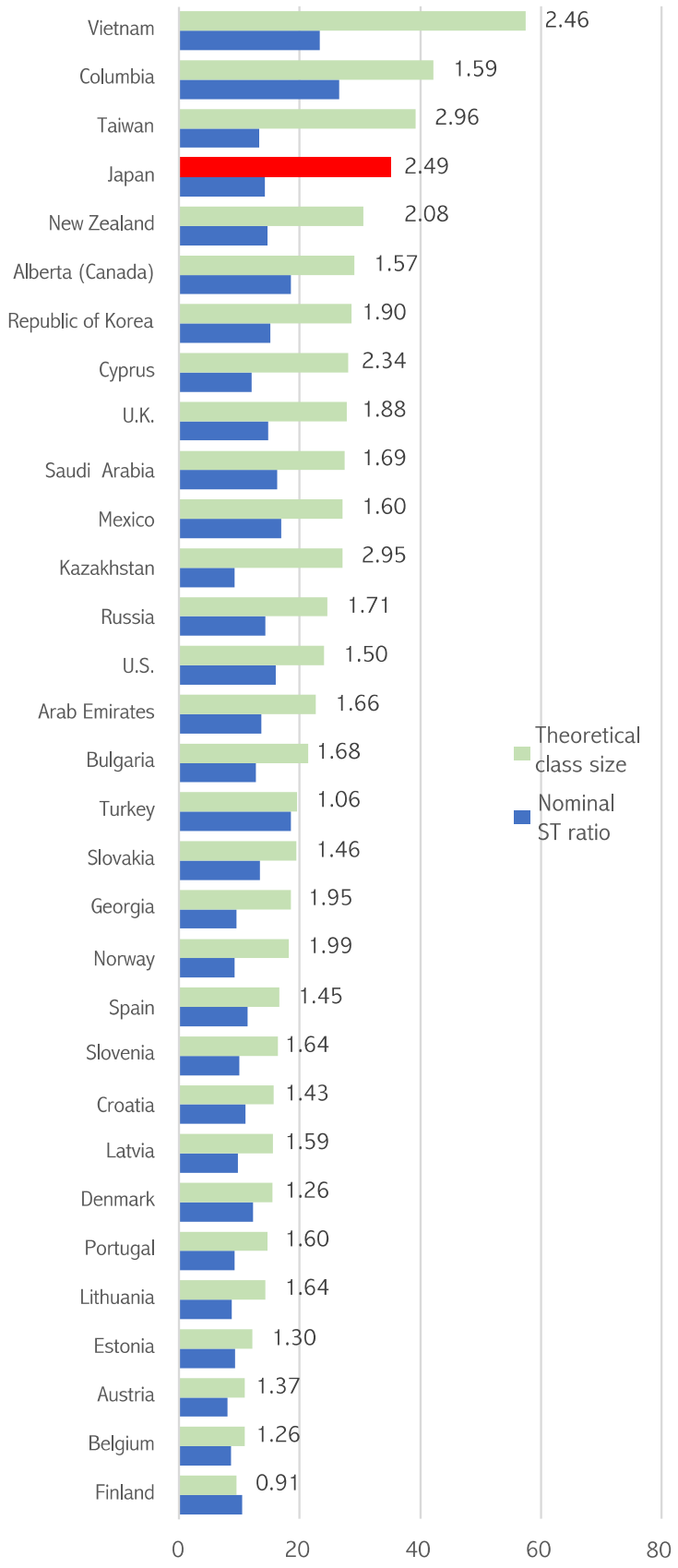


Figure 5. Professional Stress Score
(Plotted from THALIS 2018 data by Hamamoto S)

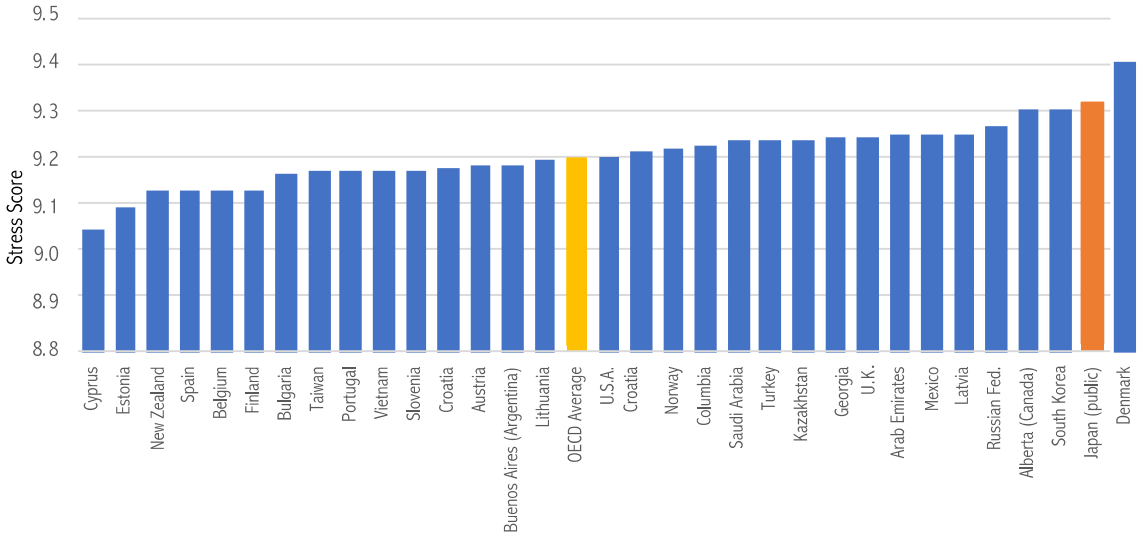
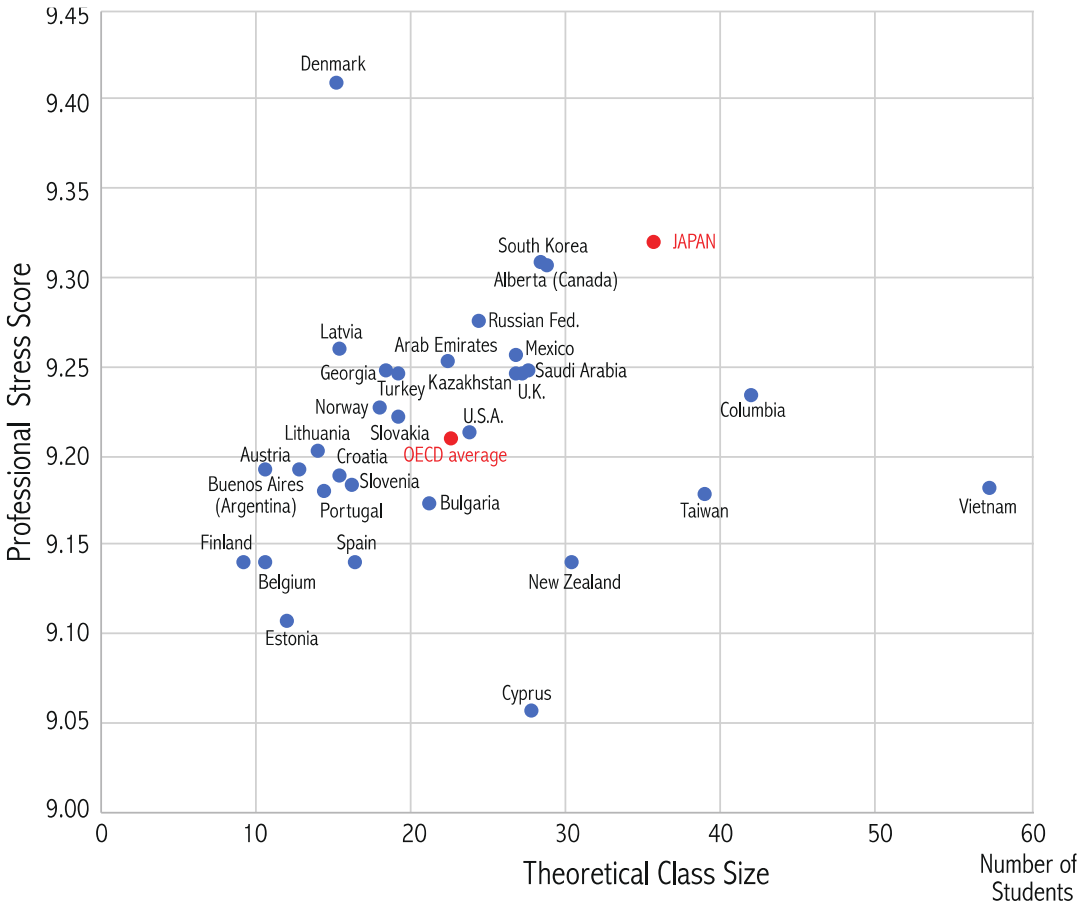


Figure 6. Theoretical Class Size and Stress Score
(Plotted from TALIS 2018 data by Hamamoto S)



2.2. Theoretical class size and teacher stress

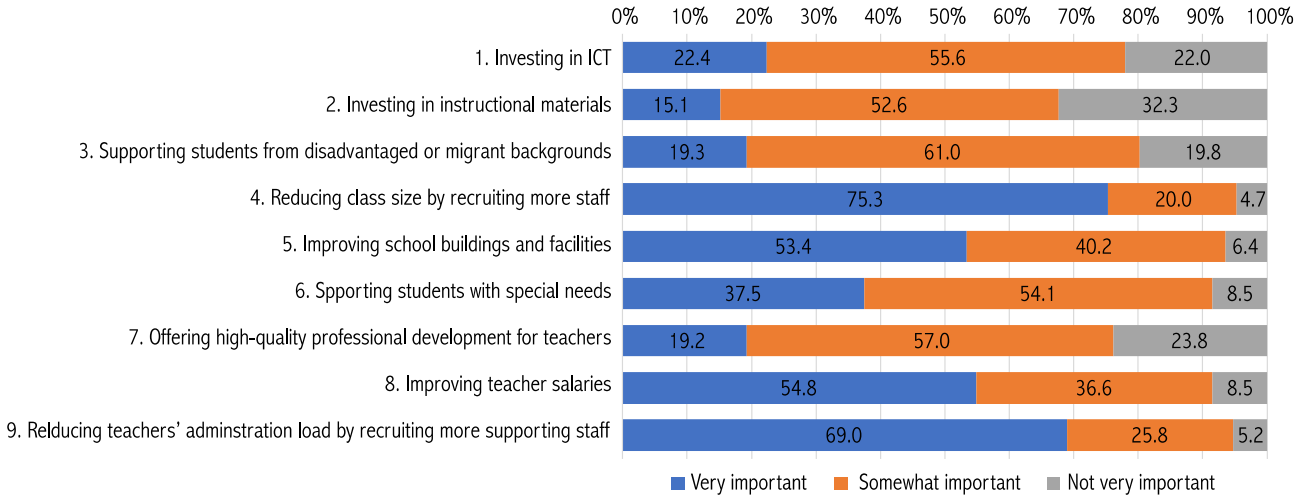
As described above, theoretical class size is a parameter based on teachers' working hours and better reflects the workload of the teachers than the nominal ST ratio. In recent years, teachers' busyness and workload has been raised as a policy issue. It has also been shown that teachers' job satisfaction is lower than in other countries (Morita and Yamamoto2015), and the popular image of teachers as a busy and stressful profession in Japan is probably related to the recent shortage of teachers.

We examine how theoretical class size, which reflects the workload of teachers, relates to teacher's stress by TALIS data analyses. Figure 5 shows that the stress level of public lower secondary school teachers in Japan is notably the highest in the world, with only Denmark showing a stress level higher than Japan. Figure 6 shows the relationship between theoretical class sizes and teachers' job stress, whereby countries with larger theoretical class sizes tend to have higher job stress scores (r = 0.142).

Kanbayashi (2015) studied the determinants of teachers' sense of busyness and burden using the Ministry of Education, Culture, Sports, Science and Technology's (MEXT) survey on teachers' working conditions. He found that increase in both regular teaching time and extra task time increases the feeling of busyness and burden. Furthermore, and even after controlling for these factors, the size of the class teachers have is the factor that raises the feeling of busyness and burden. In a time when the educational needs borne by schools are becoming more and more diverse and demanding, it is difficult to reduce extra works while keeping the same staff headcounts. To relieve teachers from the feeling of busyness and solve the future shortage of schoolteachers, It would be required to achieve even smaller class sizes so as to reduce the number of students one teacher currently faces.

Figure 7. Educational Budget Priorities (N=3,438)

(Plotted from TALIS 2018 data by Hamamoto S)



In the 2018 TALIS survey, respondents were asked to rate the importance of nine (9) policies on a five-point scale (1 to 5) with a maximum score of 3 points. The question was: "**Thinking about education for 15-year-olds as a whole, if the budget were to be increased by 5 %, how would you rate the importance of the following spending priorities?**". The results (Figure 7) show that "**4. Reducing class sizes by recruiting more staff**" scored the highest and "**9. Reducing teachers' administration load by recruiting more support staff**" came second. These results indicate an expectation for an increased number of teachers at the frontline of education.

2.3 Simulating Teachers' Stress Relief

We calculated the number of teachers and the budget required to reduce the stress level of Japanese public junior high school teachers down to the OECD average. Assuming that stress levels are determined solely by the theoretical class size of a school, it is safe to consider that reducing the theoretical class size to the OECD average level would bring the stress levels down to the OECD average as well. Hence, a means to reduce Japan's current 35.201 down to the 22.764 OECD average has to be found. To do so, reducing theoretical class size in accordance with the afore-mentioned calculation formula will be achieved by either reducing the ratio of instruction time to regular teaching hours, or by reducing the ratio of the number of students to the number of teachers (nominal ST ratio). While the number of students is assumed to be constant, to achieve the OECD average, the number of teachers need to be increased to 1.546 times relative to the current number. It is obviously unrealistic to increase the number of junior high school teachers from approximately 180,000 to 280,000 (a 1.5-fold increase): we should consider ways to reduce the theoretical class size by adjusting the working hours of teachers, as well as simply increasing the number of teachers.

Reduction of the instruction-to-teaching time ratio can be achieved by reducing the numerator, i. e., the instruction time. The ratio of instruction time to teaching time (quotient between the theoretical class size and the nominal ST ratio) in Japan is 2.491 while the OECD average is 1.758. This means that, we can reduce the coefficient of the nominal ST ratio to 1.758 by reducing instruction time per teacher to 70.5% of the current value (1.758/2.491 × 100). Moreover, the calculated theoretical class size using the hypothetical coefficient (1.758x14.131) is 24.843 which still fails to reach the OECD level of 22.764. The number of teachers to be recruited will be 24.843 / 22.764, 1.091 times the current level. Therefore, multiplying the current 180,000[1] junior high school teachers by 1.091 being necessary, 16,600 teachers need to be recruited.

Under the assumption that the annual income of a teacher is of 6.114 million yen (approx. 53,750 USD), the national treasury will bear one-third of the cost, i. e., 2,038,000 yen per teacher per year. The national treasury's burden of compulsory education expense required is 2,038,000 yen x 16,600 teachers resulting in 33.73 billion yen, which approximately represents 2.22% of the national treasury's contribution to compulsory education expenses of 2020, amounting to 1.5 trillion yen.

In summary, reducing the level of stress among teachers down to the OECD average, a 9.1% increase in the number of teachers would be necessary, while reducing the amount of time spent in extra tasks (or instruction-to-classroom teaching ratio) to 0.7 times the current level. The budget required for recruiting the necessary number of teachers represents 2.22% of the current MEXT's budget for compulsory education.

Values required for calculation

- Extra task time / regular teaching time: Japan = 2.491, OECD = 1.758 (TALIS 2018 data)
- Theoretical class size: Japan = 35.20, OECD = 22.76 (TALIS 2018 data)
- Number of teachers (national, public, teacher): 181,200 (Basic School Survey data)
- Average annual salary of teachers: 611,410 yen (data source: Fiscal System Council)
- National treasury funds for compulsory education: 1.52 trillion yen (data source: MEXT, Elementary and Secondary Education Bureau)

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