Chapter 14. Innovation by education level and broad category of practice

This chapter synthesises the changes in individual practices by grouping in four categories: the level of education (primary and secondary), the discipline (science, mathematics, reading), the type of innovation (homework, etc.), and technology-related practices.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Innovation in primary and secondary education

Innovation in primary and secondary education: moderate

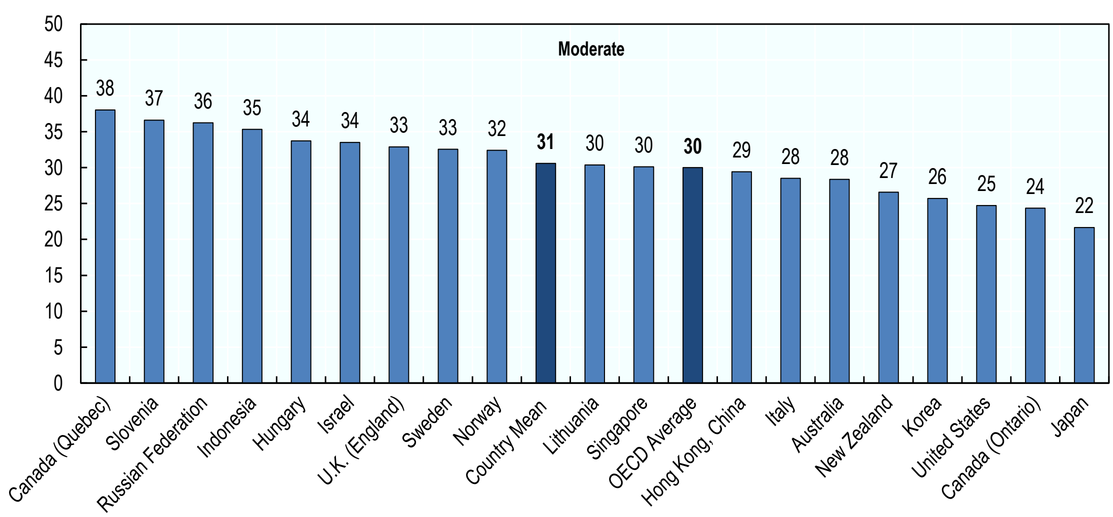
Over the past decade, all countries for which we could compute an innovation index for primary and secondary education had moderate levels of innovation. Students in Quebec (Canada), England (United Kingdom) and Slovenia have experienced the most change, whereas students in Ontario (Canada), Japan and the United States have had a more stable educational experience.

Drivers of change

What has driven innovation (or stability) varies across countries. In Quebec (Canada), innovation mainly occurred in mathematics and science education practices, while in Slovenia, the Russian Federation and England (United Kingdom), it was spread across all fields. Japanese students experienced less change than their OECD counterparts because of lower change in ICT-based practices and in mathematics education. In Ontario (Canada), lower levels of innovation came from a greater stability in secondary education and, more generally, in science education.

At the OECD level, the change was primarily driven by innovation in mathematics education, with balanced levels of change in primary and in secondary education. Practices related to peer learning among teachers as well as computer availability in schools contributed the most to the average level of innovation.

Figure 14.1. Innovation in primary and secondary education (2006-16)



Notes: The innovation index synthesises educational innovation across all education levels and practices in the covered education systems. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 40 as moderate, and over 40 as large. See Annex B for more details. For Korea (2011-2015), New Zealand (2011-2015), Australia (2011-2016) and Indonesia (2006-2011), the index has been calculated for an interval shorter than and different from 2006-16 due to unavailability of data.
Source: Authors' calculations, based on TIMSS, PIRLS and PISA Databases.

StatLink https://doi.org/10.1787/888933906538

Innovation in primary education

Innovation in primary education: moderate

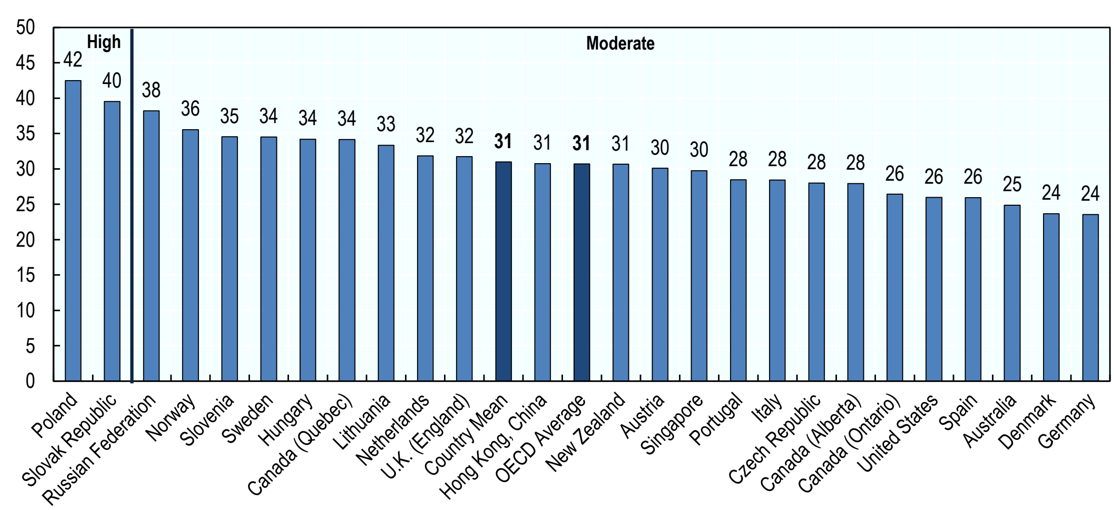
Over the past decades, almost all countries had moderate levels of innovation in primary education. In Germany, Denmark and Australia, students have experienced the least innovation in primary education practices. In Poland, the Slovak Republic and the Russian Federation, students were exposed to the greatest levels. (Poland is not fully comparable though, as innovation is measured over a shorter period for some indicators (2011-2015)).

Drivers of change

The drivers of change differ among the countries with the most and least changes. In Poland, there was more innovation in science education practices than in mathematics, while the reverse is true in the Slovak Republic. In both countries, reading practices have remained more stable. At the lower other end of innovation, students in Denmark and Germany experienced little change across all disciplines. In fact, in primary education, change in mathematics and science education practices was similar, at a moderate level, while reading practices remained more stable.

At a more detailed level, students experienced the most change in the use of computers in maths, science and reading lessons. They were exposed to little change in reading pedagogical practices and in the formal training received by their teachers.

Figure 14.2. Innovation in primary education (2006-16)



Note: The index synthesises changes in all primary education practices. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. See Annex B for more details. For Poland (2011-2015), Slovak Republic (2011-2016), Austria (2011-2016), Czech Republic (2011-2016), Canada (Alberta) (2006-2011) and Spain (2011-2015), the index has been calculated for an interval shorter than and different from 2006-16 due to unavailability of data

Source: Authors' calculations based on TIMSS and PIRLS Databases.

StatLink https://doi.org/10.1787/888933906557

Innovation in secondary education

Innovation in secondary education: moderate

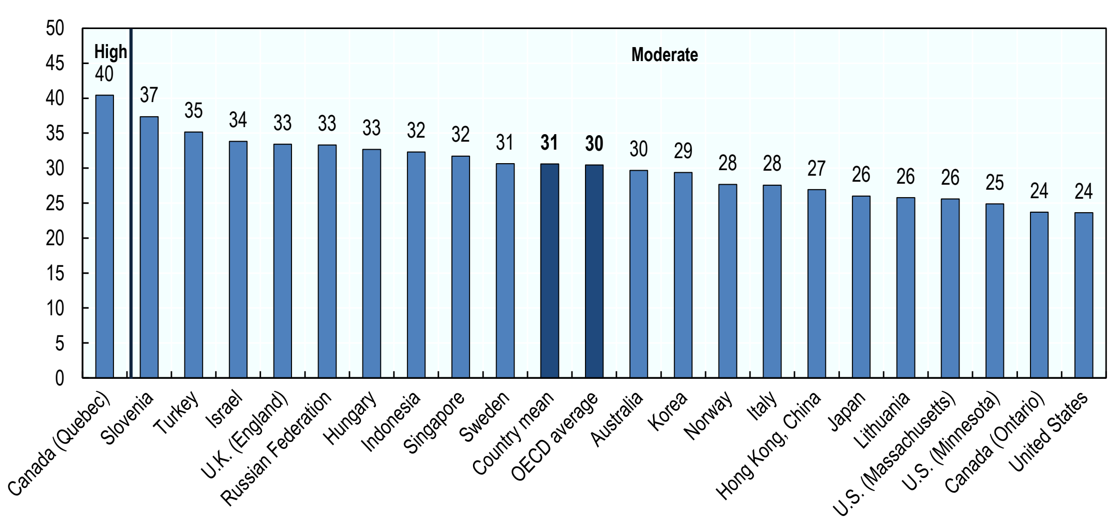
Innovation in educational practices in secondary education has been moderate. Students in Quebec (Canada) have experienced large levels of innovation in secondary education, followed by students Slovenia, Turkey and Israel. On the contrary, in the United States, students experienced a moderate-low level of innovation in secondary education, both at the country level and in the US states covered in the report. Students in Ontario (Canada) were also exposed to relatively little change in their educational practices in secondary education, a contrast to their peers in the neighbouring Quebec province.

Drivers of change

Changes in mathematics education practices explain the high levels of innovation in Quebec and Slovenia. In Turkey, innovation was evenly distributed between maths and science education practices. In Quebec and Slovenia, the decrease in computer availability in school was a significant change for students. As for the more stable systems, the United States recorded only modest changes in maths and science education practices, with very little change in school level and non-disciplinary practices.

Overall, innovation in secondary education has mainly affected maths education practices. Teacher professional development through peer learning as well as homework practices have contributed the most to change, while the share of students with teachers having taken some formal teacher training remained very stable.

Figure 14.3. Innovation in secondary education (2006-15)



Note: The index synthesises changes in all secondary education practices. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. See Annex B for more details. For Massachusetts and Minnesota (United States) (2007-2011), the index has been calculated for an interval shorter than and different from 2006-15 due to unavailability of data
Source: Authors' calculations based on TIMSS and PISA Databases.

StatLink https://doi.org/10.1787/888933906576

Innovation in reading education

Innovation in reading education: moderate

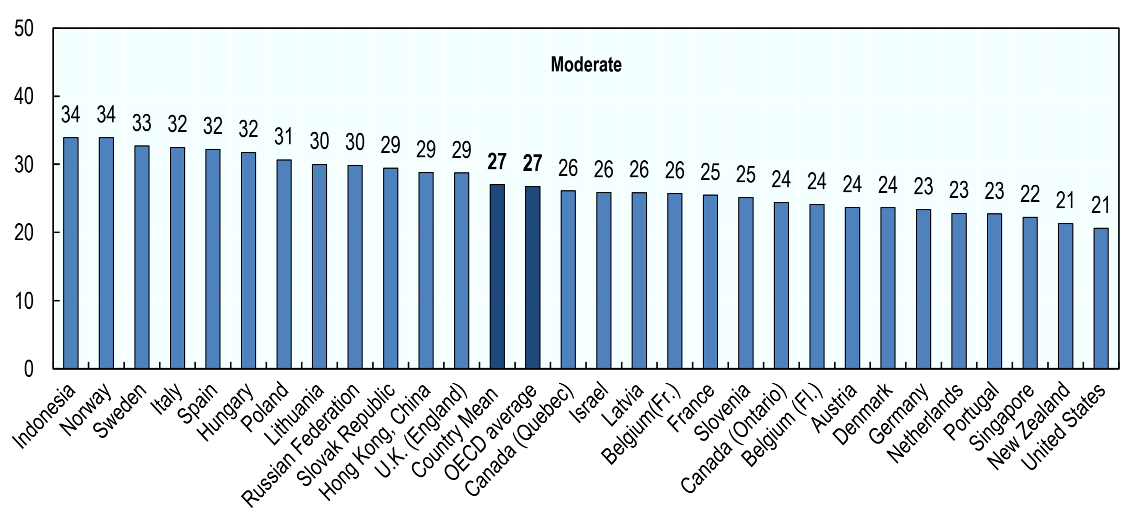
Innovation in reading practices in primary education has been moderate on average, and a bit lower than in maths and science. There was less variation and amplitude in innovation levels across countries compared to science and maths education. Students in Norway, Sweden and Indonesia (albeit over a shorter time period) have experienced the most innovation in their reading teaching and learning practices. In the United States, New Zealand and Singapore, pedagogical practices related to reading remained relatively stable.

Drivers of change

A common driver of change in reading teaching and learning practices across education systems lay in a significant change in the use and availability of ICT in reading lessons. Otherwise, innovation in reading education practices can be traced back to system-specific changes rather than common international patterns. Changes in specific practices did not necessarily go in the same direction across systems.

In Indonesia, students were exposed to more innovation in assessment practices; in Sweden and Norway, what changed the most for students included a variety of other areas, from collaborative or personalised practices in reading to practices aiming to develop language art skills. In these three countries, reduced access to computers in reading lessons was a major common change for students at the system level.

Figure 14.4. Innovation in reading education (2006-16)



Note: The index synthesises changes in reading education practices in primary education. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. See Annex B for more details. For Indonesia (2006-2011), Slovak Republic (2011-2016) and Portugal (2011-2016), the index has been calculated for an interval shorter than and different from 2006-16 due to unavailability of data

Source: Authors' calculations. Based on PIRLS Databases.

StatLink https://doi.org/10.1787/888933906595

Innovation in mathematics education

Innovation in mathematics education: moderate

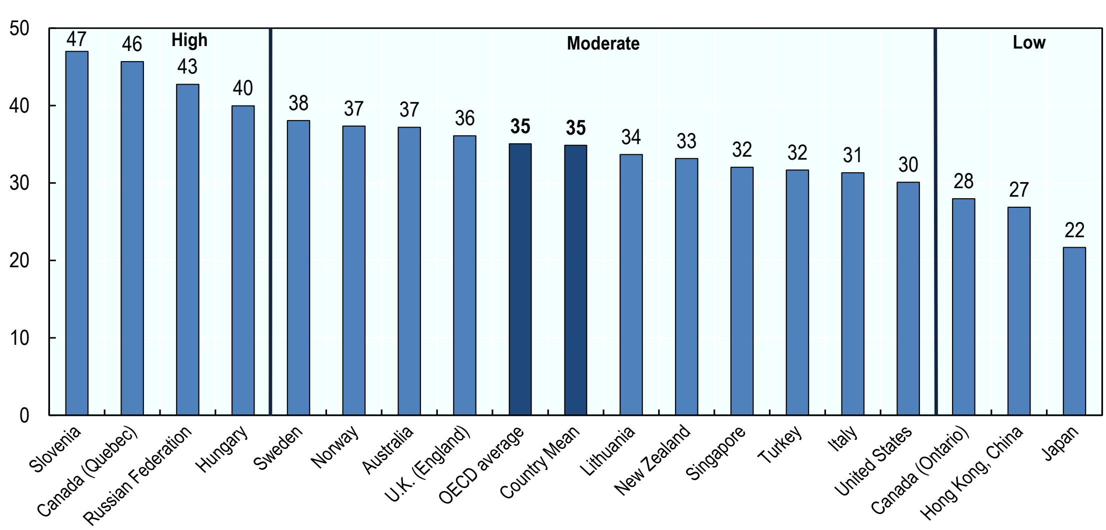
Innovation in maths education practices in primary and secondary education has been moderate on average, but larger than innovation levels in science or reading. This has been the field in which students have experienced the most change in their educational experience in the OECD area over the past decade. In Slovenia, Quebec (Canada), the Russian Federation and Hungary, students have experienced large levels of change between 2007 and 2015. At the other end, maths education in Japan has remained relatively stable compared to other countries. There were significant differences in the magnitude of change across countries: Slovenia recorded over twice as much innovation in maths education practices as Japan.

Drivers of change

In most of the countries where maths education practices have seen large changes, it happened more in primary than in secondary education. Large changes occurred in computer availability and use during maths lessons. In Slovenia, students experienced large changes in the assessment practices in maths education. Across the board, professional development through peer learning among maths teachers also explains this relatively large level of innovation.

On average, innovation came from substantial changes in ICT use in maths lessons and in more students having teachers doing professional development through peer-learning activities.

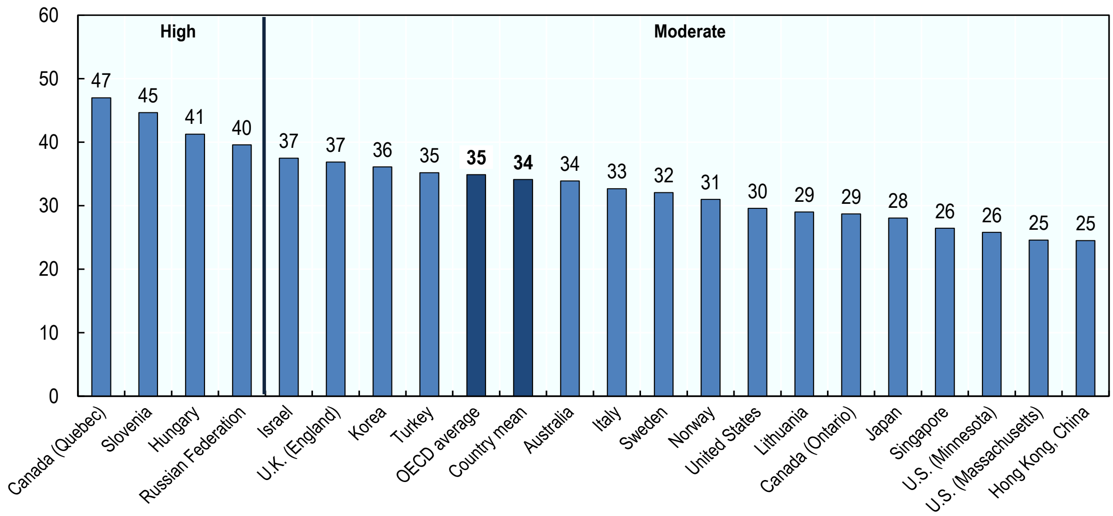
Figure 14.5. Innovation in mathematics education (2007-15)



Note: magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. See Annex B for more details. For Turkey (2011-2015) and New Zealand (2011-2015), the index has been calculated for an interval shorter than and different from 2007-15 due to unavailability of data.
Source: Authors' calculations Based on TIMSS Databases.

StatLink https://doi.org/10.1787/888933906614

Figure 14.6. Innovation in secondary mathematics education (2007-15)



Note: For U.S. (Minnesota) and U.S. (Massachusetts), the index has been calculated for 2007-11 instead of 2007-15 due to unavailability of data

Source: Authors' calculations based on TIMSS databases.

StatLink https://doi.org/10.1787/888933906633

Innovation in science education

Innovation in science education: moderate

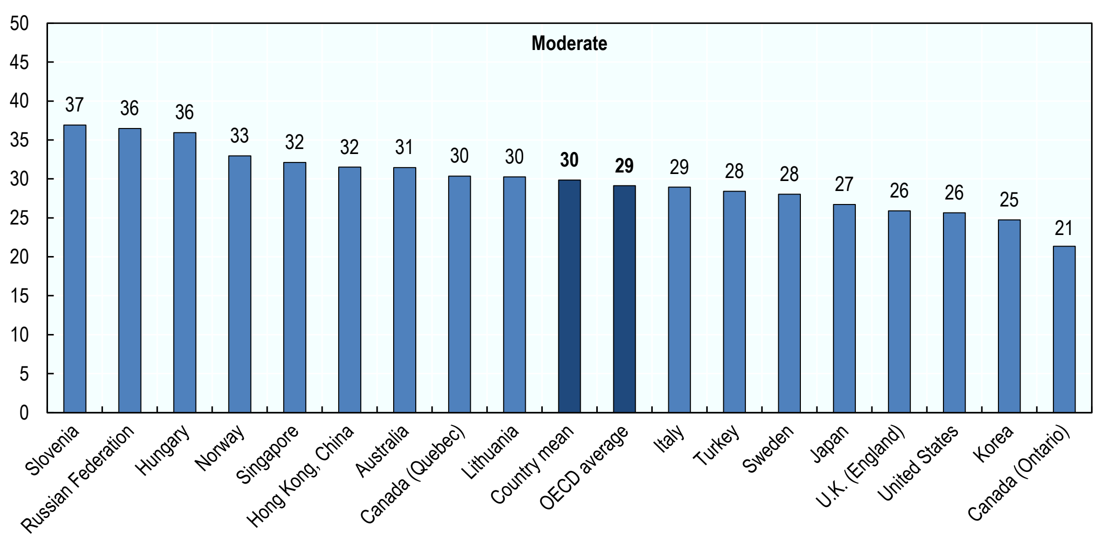
Innovation in science education practices in primary and secondary education has been moderate on average. Students in Slovenia experienced the largest change in science education practices, as was also the case for maths education. Innovation was also relatively large in the Russian Federation and Hungary. Students in Ontario (Canada) experienced only modest changes in science education practices, less than in other systems.

Drivers of change

On average, changes in science practices across the OECD area have been equally distributed between primary and secondary education. The main areas of change were the use of ICT in science class, of teacher peer learning and of both active learning and direct transmission teaching practices.

Countries with the most innovation have often experienced more changes in primary than in secondary education. In education systems where innovation in science education has been smaller, innovation was more evenly balanced between primary and secondary education. The practices that have changed the most vary across countries. Slovenia experienced high levels of innovation in assessment practices, the Russian Federation, high levels of innovation in ICT-based practices, and Hungary, significant changes in independent knowledge acquisition practices. There was thus no common innovation pattern across countries.

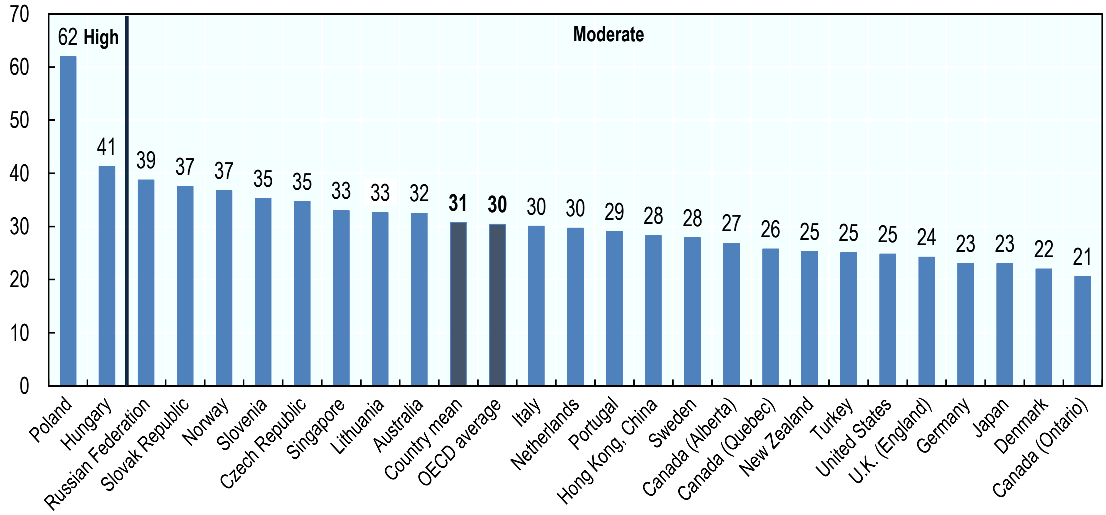
Figure 14.7. Innovation in science education (2006-15)



Note: The index synthesises changes in all science education practices in primary and secondary education. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. See Annex B for more details. For Turkey (2011-2015) and Korea (2011-2015), the index has been calculated for an interval shorter than and different from 2006-15 due to unavailability of data.
Source: Authors' calculations based on TIMSS and PISA Databases;

StatLink https://doi.org/10.1787/888933906652

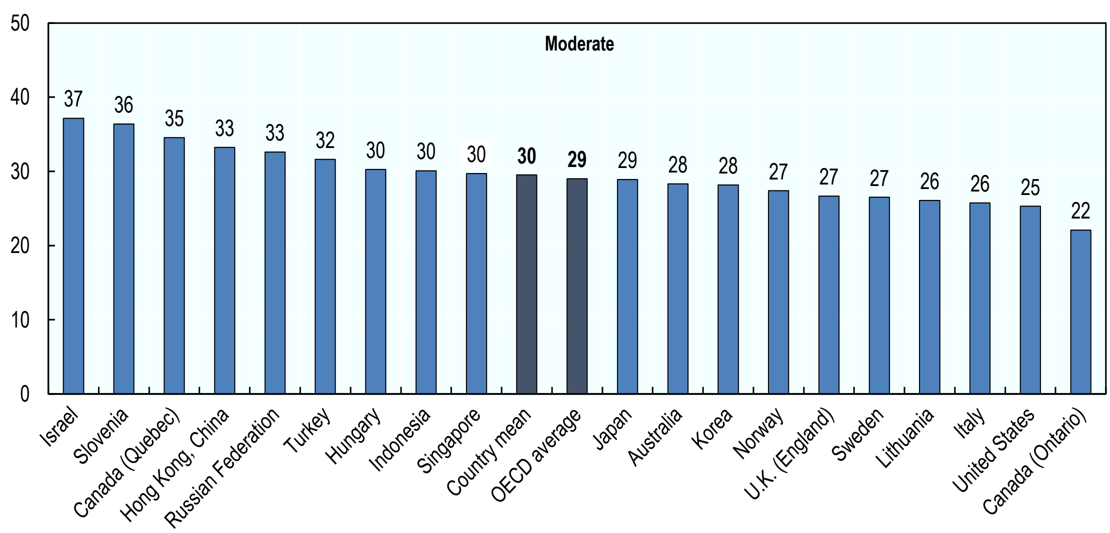
Figure 14.8. Innovation in primary science education (2007-15)



Note: For Turkey and Portugal, the index has been calculated for 2011-15 instead of 2007-15 due to unavailability of data
Source: Authors' calculations based on TIMSS Databases.

StatLink https://doi.org/10.1787/888933906671

Figure 14.9. Innovation in secondary science education (2006-2015)



Note: For Indonesia, the index has been calculated for 2007-11 instead of 2007-15 due to unavailability of data
Source: Authors' calculations based on TIMSS and PISA Databases.

StatLink https://doi.org/10.1787/888933906690

Innovation in the availability of computers in schools

Innovation in the availability of computers in schools: large

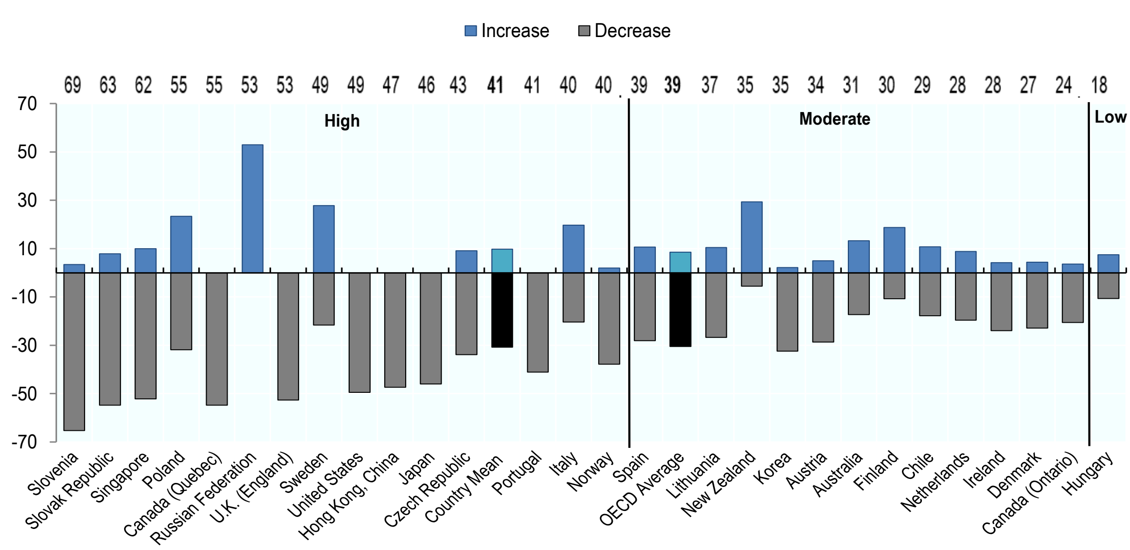
Students have experienced large innovation in the availability of computers (including tablets) for use in primary and secondary school lessons over the past decade. As digitalisation has made ICT ubiquitous, this may appear paradoxical. The levels of availability remain high (at about 80% of students having access on average for most indicators), but there was a consistent downward trend that correspond to a large effect size. This trend may be explained by a learning curve about the right amount and availability of devices in school. It is also possible that computer availability has taken new forms that are not captured by the international surveys used in this report, for example the use of students' personal devices or the use of computers outside of class.

In the Russian Federation, there was no decrease in any indicator of computer availability. New Zealand, Sweden and Finland experienced more increase than decrease. In all other countries, change mainly corresponded to a decrease in computer availability, with the largest decreases in Slovenia, Quebec (Canada) and the Slovak Republic.

Drivers of change

In all countries, students were exposed to large decreases in the availability of computers in school and during maths, sciences and reading lessons. Portable computers have become more available (except in Japan and Portugal).

Figure 14.10. Innovation in ICT availability in schools (2006-16)



Note: The index synthesises innovation in computer availability in school and during lessons. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index for ICT availability computed by summing the absolute values of increases and decreases. See Annex B for more details. For Ireland (2011-2016), Chile (2011-2015), Finland (2011-2016) and Portugal (2011-2016) the index has been calculated for an interval different from 2006-16 due to unavailability of data.
Source: Authors' calculations based on TIMSS, PIRLS and PISA Databases.

StatLink https://doi.org/10.1787/888933906709

Innovation in the use of ICT in schools

Innovation in the use of ICT in schools: moderate

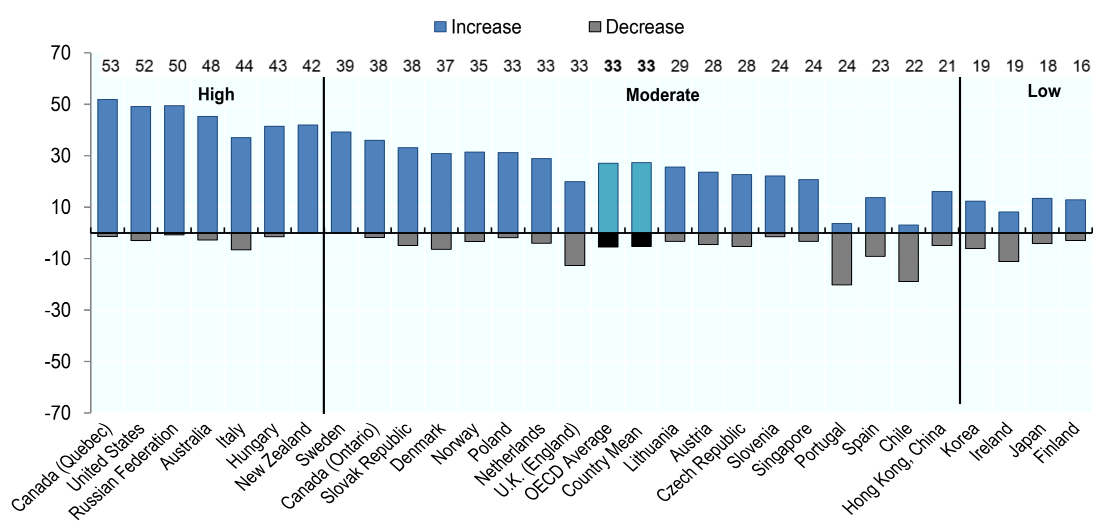
Where computers are available, more students have used them in their lesson or in schools over the past decades than in the past. Computers were used for multiple uses: practising maths, science or foreign languages, simulations, writing, or just looking for information. The use of ICT can enhance knowledge acquisition strategies, active learning pedagogies as well as the fostering of higher order skills.

On average, students have been exposed to moderate levels of innovation in the use of ICT in the last decade, with most pedagogical practices using ICT gaining rather than losing ground. Portugal, Chile and Ireland are the only countries where the use of ICT in schools has lost ground. Systems where these practices have increased significantly included Quebec (Canada), the Russian Federation, the United States, Australia, Italy and Hungary. In New Zealand and Sweden, all ICT-use related practices have increased.

Drivers of change

In primary education, this increase is almost equally distributed across maths, science and reading education, with all three disciplines seeing large net increases. Major increases have concerned computer use to practice skills and procedures in both maths and science classes as well as to supplement reading lessons. In secondary education, decreasing ICT use occurred in maths education while increased ICT use was equally distributed between maths and science education. Similarly in secondary education, more students used computers to perform learning activities in maths and science. The share of students taught by teachers who received training on how to teach with ICT has decreased.

Figure 14.11. Innovation in ICT use in schools (2006-16)



Note: The index synthesises innovation in computer and ICT use in school and during lessons, conditioned to the availability of computers in schools or lessons. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in ICT use computed by summing the absolute values of increases and decreases. See Annex B for more details. For Finland (2011-2016), Ireland (2011-2016), Chile (2011-2015) and Portugal (2011-2016) the index has been calculated for an interval different from 2006-16 due to unavailability of data.
Source: Authors' calculations Based on TIMSS, PIRLS and PISA Databases.

StatLink https://doi.org/10.1787/888933906728

Innovation in homework practices

Innovation in homework practices: moderate

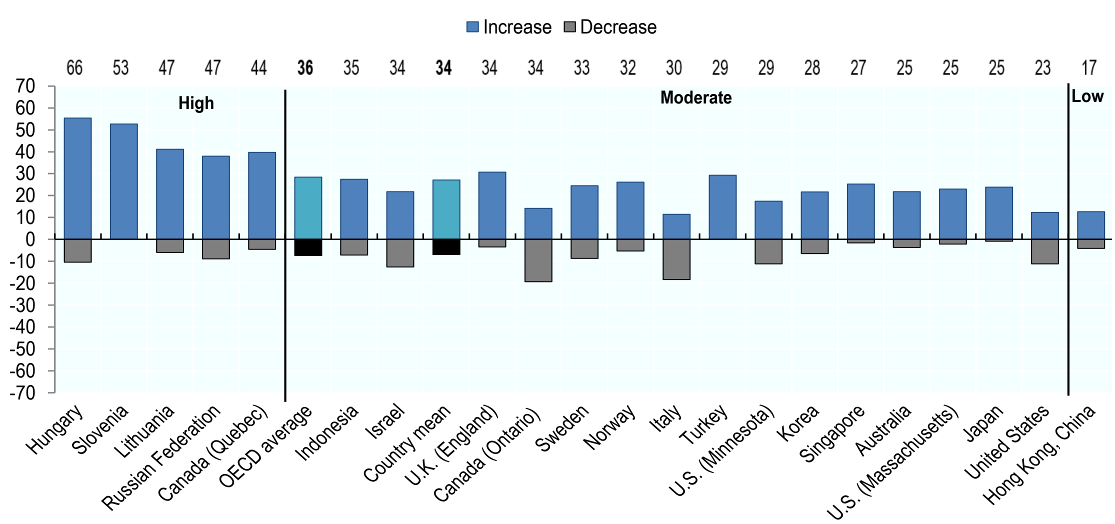
Innovation in the frequency, assessment and monitoring of homework in secondary education has been moderate in the past decade, but moderate-high. The practices covered include the frequency of homework, how homework is corrected, whether it is discussed in class, etc.

On average, students in the OECD area have seen the use of homework become more important in their science and maths education in the past decade. Students in Slovenia recorded no decreases in any homework practice covered, and alongside Hungary, Lithuania, Quebec (Canada) and the Russian Federation, experienced the largest levels of innovation in the use of homework practices. Apart from Ontario (Canada) and Italy, innovation was mainly driven by the spread of these practices. In fact, Italy and Ontario are the only places where homework has become less important to students' education, with considerable decreases in both homework frequency and the monitoring of their completion.

Drivers of change

Most of the covered practices increased rather than decreased. In particular, discussion of maths and science homework in class has expanded significantly. While the frequency of homework has remained steady on average, it has increased significantly in a few countries and decreased moderately in most. On the other hand, monitoring homework completion has decreased in several countries: this is a worrisome innovation.

Figure 14.12. Innovation in homework practices (2007-15)



Note: The index synthesises innovation in homework practices. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in homework practices computed by summing the absolute values of increases and decreases. See Annex B for more details. For U.S. (Massachusetts), U.S. (Minnesota) and Indonesia the index has been calculated for the interval 2007-2011 instead of 2007-15 due to unavailability of data.
Source: Authors' calculations based on the TIMSS Databases.

StatLink https://doi.org/10.1787/888933906747

Innovation in assessment practices

Innovation in assessment practices: moderate

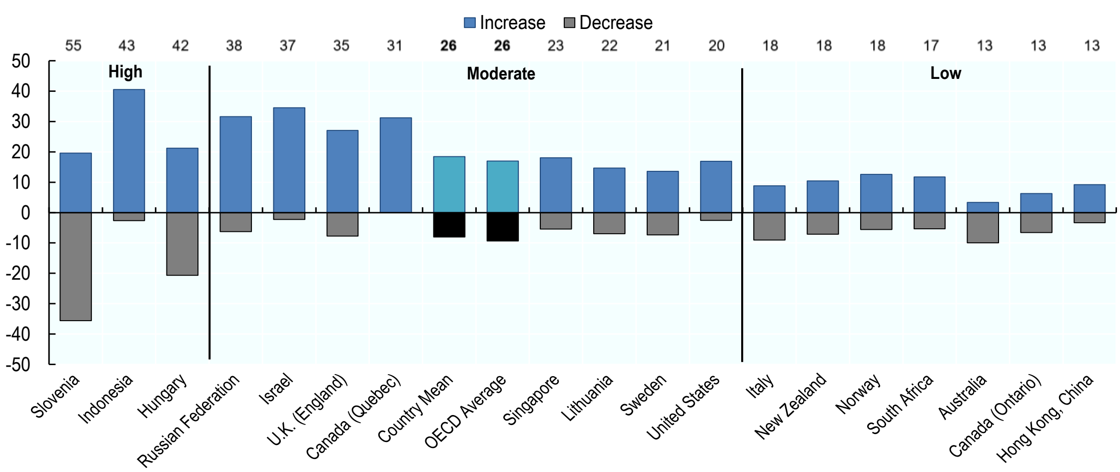
Assessment practices are an integral part of pedagogy, and increasingly of the monitoring of education systems. The assessment practices covered in this index include the frequency of feedback and correction of assignment, the importance of classroom tests, the emphasis on national or regional achievement tests.

On average, the use or emphasis on assessment has become more prevalent in students' education in the OECD area in the past decade. A majority of systems have placed more importance on assessment in their students' education. However, innovation in this area has taken two directions: the spread of some assessment practices has often been accompanied by a (smaller) decrease in others. Hungary and Slovenia registered large levels of innovation in this domain. In Slovenia, the emphasis on national and regional tests has decreased significantly, while classroom tests became less prevalent. In Hungary on the contrary, classroom tests have lost ground while the emphasis on regional and national achievement tests has increased. On the other hand, in Indonesia, Israel and Quebec (Canada), assessment has become more important in students' education. Students in Quebec have experienced an increase in all practices. In Quebec and Indonesia, tests in reading lessons have spread significantly, while in Israel assessment has mostly become more important in maths and science.

Drivers of change

The diffusion of written and classroom tests in reading lessons has increased significantly in primary education. In secondary education, classroom tests increased more in science than in maths. The emphasis placed on national or regional or achievement tests increased in both science and maths.

Figure 14.13. Innovation in assessment practices (2006-16)



Note: The index synthesises innovation in assessment practices. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in assessment practices computed by summing the absolute values of increases and decreases. See Annex B for more details. For Australia (2006-2011), South Africa (2011-2015), New Zealand (2011-2015) and Indonesia (2007-2011).

Source: Authors' calculations based on the TIMSS and PIRLS Databases.

StatLink https://doi.org/10.1787/888933906766

Innovation in active learning practices in science education

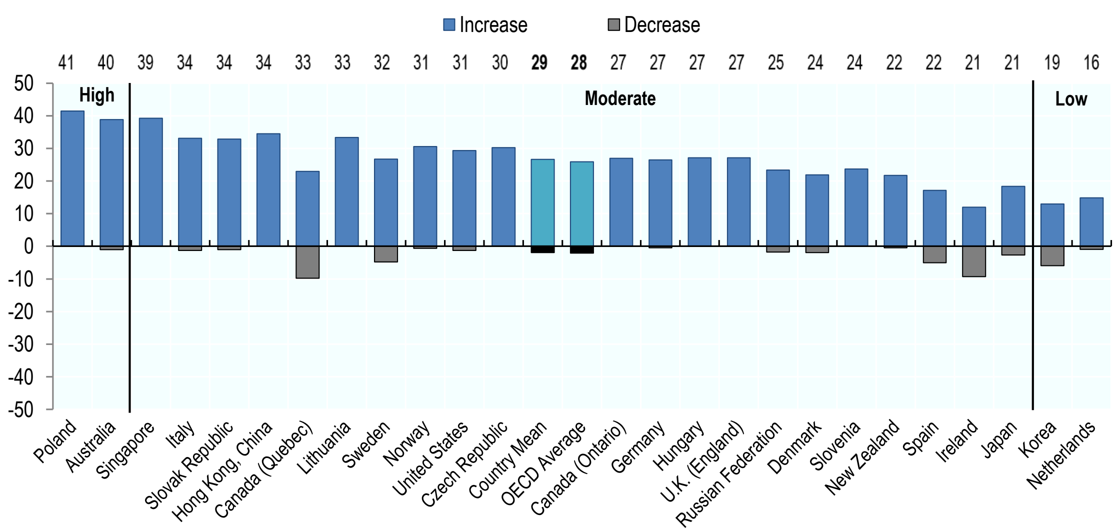
Innovation in active learning in science education: moderate

Active learning practices are usually promoted as engaging and well suited for students to understand the nature of science. The covered active learning practices revolved around conducting, designing or simulating science experiments in primary and secondary education. On average, students have become more exposed to these practices over the past decade, which have corresponded to a moderate innovation. The direction of innovation has been relatively univocal, with only a few education systems experiencing small declines in some of these pedagogical activities. In Poland, Australia and Singapore, active learning in science has increased significantly. Conversely, in the Netherlands and Korea, they have remained pretty stable.

Drivers of change

Active learning practices have particularly spread in primary science lessons, the main area of innovation in this area. For instance, more primary education students are given the opportunity to conduct or design experiments in science. Active learning pedagogies enhanced by ICT have also gained ground in both primary and secondary science education.

Figure 14.14. Innovation in active learning practices in science education (2006-15)



Note: The index synthesises innovation in active learning practices in science in primary and secondary education. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in active learning practices in science computed by summing the absolute values of increases and decreases. See Annex B for more details. For Ireland (2011-2015), Spain (2011-2015) and Poland (2011-2015) the index has been calculated for an interval different from 2006-15 due to unavailability of data
Source: Authors' calculations Based on the TIMSS and PIRLS databases.

StatLink https://doi.org/10.1787/888933906785

Innovation in practices fostering higher order skills

Innovation in practices fostering higher order skills: moderate

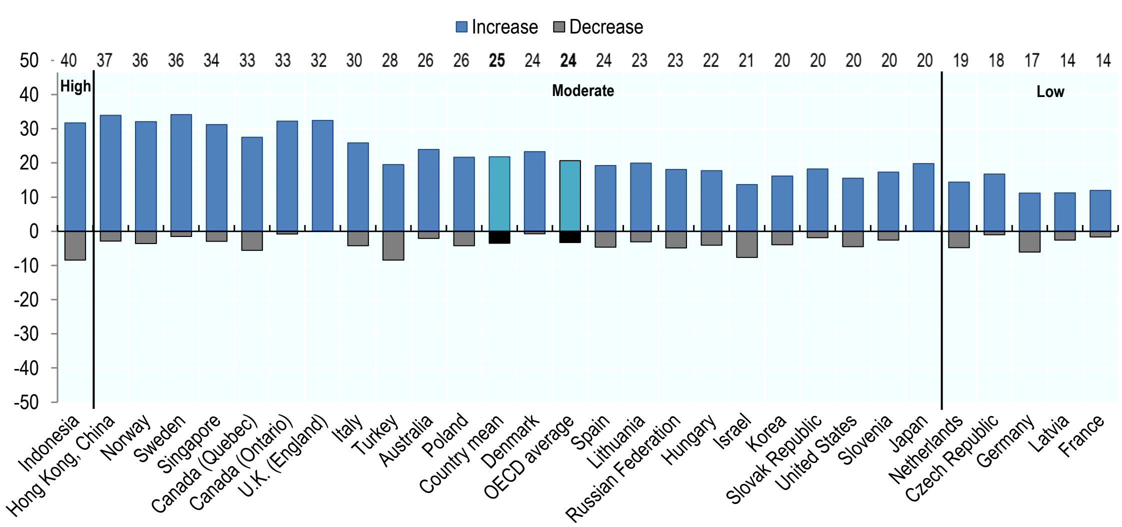
Many systems have put more emphasis in their curricula and policy discourse on the fostering of higher order skills, involving a deeper understanding of read texts or scientific phenomena, the development of critical thinking, the ability to draw inferences, to solve more complex problems, to be more observant and imaginative, etc.

On average, educational practices targeting the acquisition of higher order skills have spread across education systems, and have constituted a moderate-low innovation. Students in Indonesia and Honk Kong (China) have experienced larger innovation in this domain. These practices have also gained ground in Norway, Sweden, Singapore, Ontario (Canada) and England (United Kingdom). Reading lessons concentrated a large share of the innovation in this area in Indonesia, Honk Kong (China), Norway and Sweden: more students were often asked to predict what will happen after reading a text or to draw inferences from a reading. In France, Latvia, Germany and the Czech Republic, there was only very little innovation in this area.

Drivers of change

At the OECD level, most of the innovation in this domain has taken place in science education. For instance, more students across the OECD were asked to observe and describe natural phenomena or design scientific experiments in primary and secondary education. At the same time, many other science practices remained very stable.

Figure 14.15. Innovation in practices fostering higher order skills (2006-16)



Note: The index synthesises innovation in practices fostering higher order skills. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in practices fostering high order skills computed by summing the absolute values of increases and decreases. See Annex B for more details. For the Czech Republic (2006-2011) and Indonesia (2006-2011) the index has been calculated for an interval different from 2006-16 due to unavailability of data
Source: Authors' calculations Based TIMSS, PISA and PIRLS Databases.

StatLink https://doi.org/10.1787/888933906804

Innovation in rote learning practices

Innovation in rote learning practices: moderate

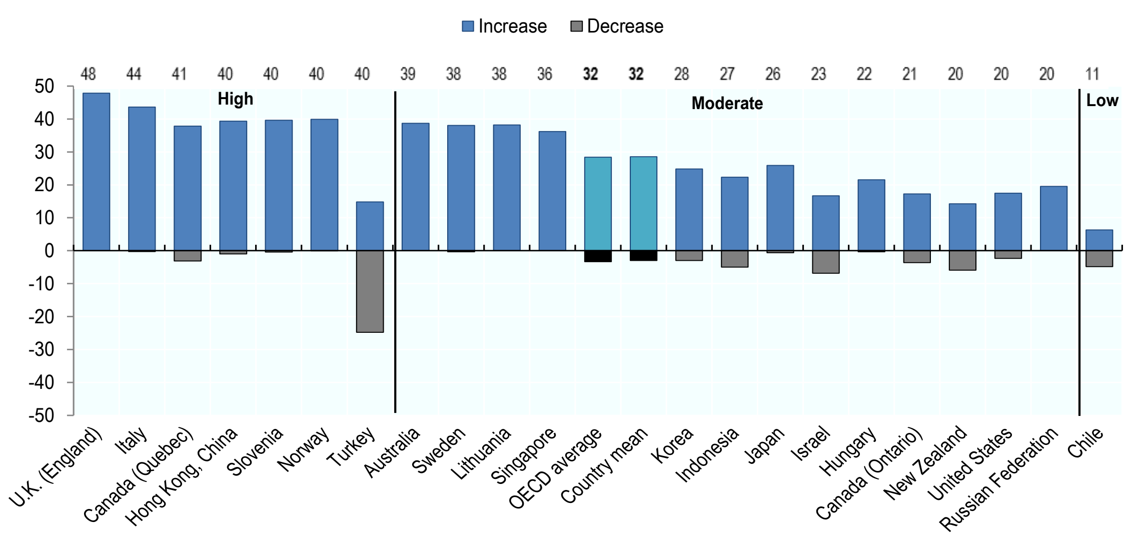
Rote learning has its strong critiques and promoters. While there should be some balance with other types of learning strategies, memorising rules, procedures and facts, reproducing procedures or learning new vocabulary systematically remain key learning practices.

In the last decade, more students have been exposed to rote learning practices, which constituted a moderate-high innovation. In England (United Kingdom), Italy, Quebec (Canada), Hong Kong (China), Slovenia or Norway, these practices have gained ground. In England, rote learning practices expanded in maths and to a lesser extent in science. In Italy, the use of memorisation in secondary education, in both maths and science lessons, has risen. In Quebec, innovation in this area mainly came from science. There was in fact no common pattern across countries with the most change. Turkey is the only country where students experienced high levels of innovation in this domain with a mix of decline and expansion of some of these pedagogical practices.

Drivers of change

On average, the magnitude of change was similar between maths and science education, as well as between primary and secondary education.

Figure 14.16. Innovation in rote learning practices (2006-16)



Note: The index synthesises innovation in rote learning practices in maths and science in primary and secondary education, and to a lesser extent in reading. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in rote learning practices computed by summing the absolute values of increases and decreases. See Annex B for more details. For Chile (2011-2016) and New Zealand (2011-2016) the index has been calculated for an interval different from 2006-16 due to unavailability of data

Source: Authors' calculation Based on TIMSS, PIRLS and PISA Databases.

StatLink https://doi.org/10.1787/888933906823

Innovation in independent knowledge acquisition practices

Innovation in independent knowledge acquisition: large

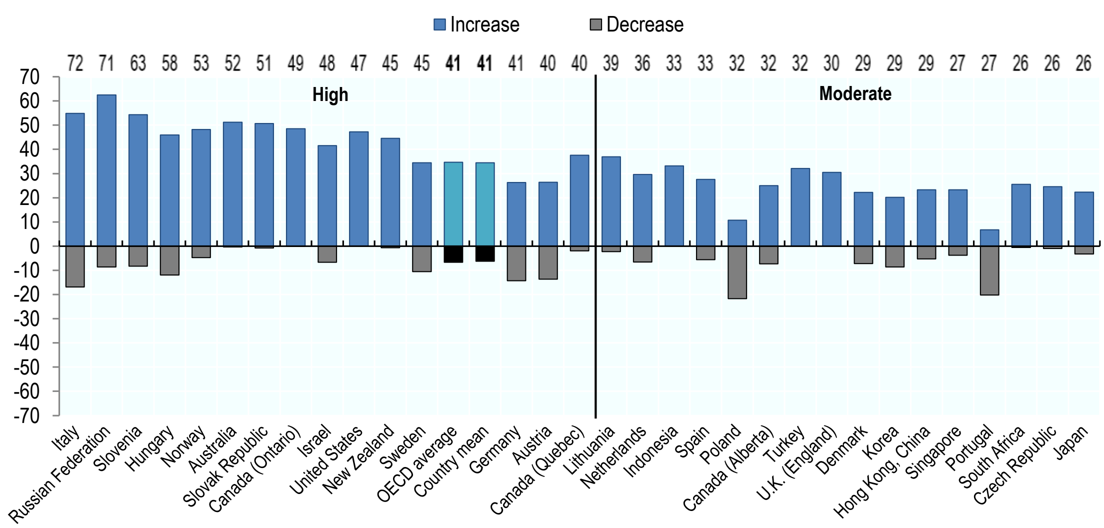
As part of the learning process, students are often asked to read books, textbooks and other resources or to look up for information and ideas on the Internet during class. This is what we call “independent knowledge acquisition”.

On average, innovation in this area has been large in the past decade. In Italy, the Russian Federation, Slovenia, Hungary, Australia, the Slovak Republic, Ontario (Canada), Israel, the United States or New Zealand, students were exposed to large innovation in this area, with mainly an expansion of those covered practices. Japan experienced a moderate-low level of innovation in this area.

Drivers of change

Innovation in this domain came from the spread of ICT-based practices to independently acquire knowledge in maths, science and reading: more primary and secondary students were regularly asked to use computer to look up for information and ideas during class in these three disciplines. This has particularly expanded in primary maths lessons. Very little change is observed concerning the reading of science textbooks. The main decrease recorded across countries corresponded to less students being asked to read non-fiction books in reading lessons.

Figure 14.17. Innovation in independent knowledge acquisition practices (2006-16)



Note: The index synthesises innovation in independent knowledge acquisition practices in science, maths and reading in primary and secondary education. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in independent knowledge acquisition practices computed by summing the absolute values of increases and decreases. See Annex B for more details. For South Africa (2006-2011), Portugal (2011-2016), Turkey (2011-2015), Poland (2011-2015), Spain (2011-2015) and Indonesia (2006-2011) the index has been calculated for an interval different from 2006-16 due to unavailability of data.
Source: Authors' calculations based on TIMSS and PIRLS Databases.

StatLink https://doi.org/10.1787/888933906842

Innovation in the availability of school learning resources

Innovation in the availability of school learning resources: moderate

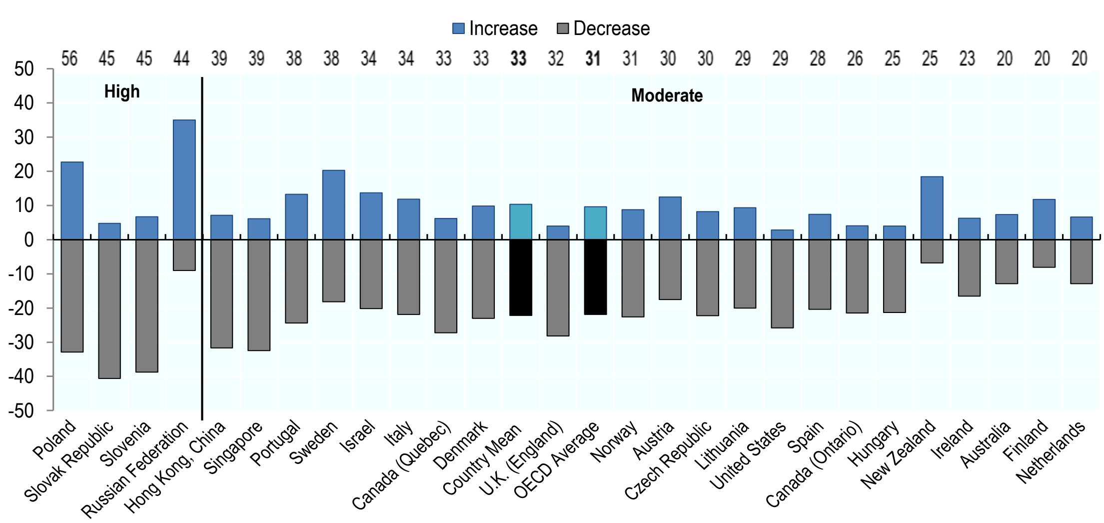
Learning resources available at school cover mainly two big areas in this report: the availability of reading resources (a library in the school or reading corners in classrooms) and the availability of computers in school or in class (including laptops or tablets). These learning resources available in school are of course supplemented by those available at home or in other public institutions (e.g. municipal library, if any).

Innovation in this domain has been moderate and has mainly taken the form of less students having access to the covered learning resources in their school or in their class. Students in Poland, the Slovak Republic, Slovenia and the Russian Federation have experienced big changes in the availability of learning resources at school. While this is driven by reduced availability in the first three systems, in the Russian Federation there has been a huge increase in learning resource availability. In the Netherlands, Australia, and Finland, availability remained largely stable.

Drivers of the change

The decreasing availability of ICT resources, especially in the reading discipline, explains the change to a large extent. Less primary students also had access to a school library. Portable computers in schools are the only resource that has become consistently more available in schools, Portugal and Hong Kong (China) being the only two exceptions.

Figure 14.18. Innovation in the availability of school learning resources (2006-16)



Note: The index synthesises innovation in the availability of learning resources in school in science, maths and reading classes in primary and secondary education. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in the availability of school learning resources computed by summing the absolute values of increases and decreases. See Annex B for more details. For Finland (2011-2016), Ireland (2011-2016), the Czech Republic (2011-2016) and Portugal (2011-2016) the index has been calculated for an interval different from 2006-16 due to unavailability of data
Source: Authors' calculations based on TIMSS, PIRLS and PISA Databases.

StatLink https://doi.org/10.1787/888933906861

Innovation in formal teacher training

Innovation in teacher training: moderate

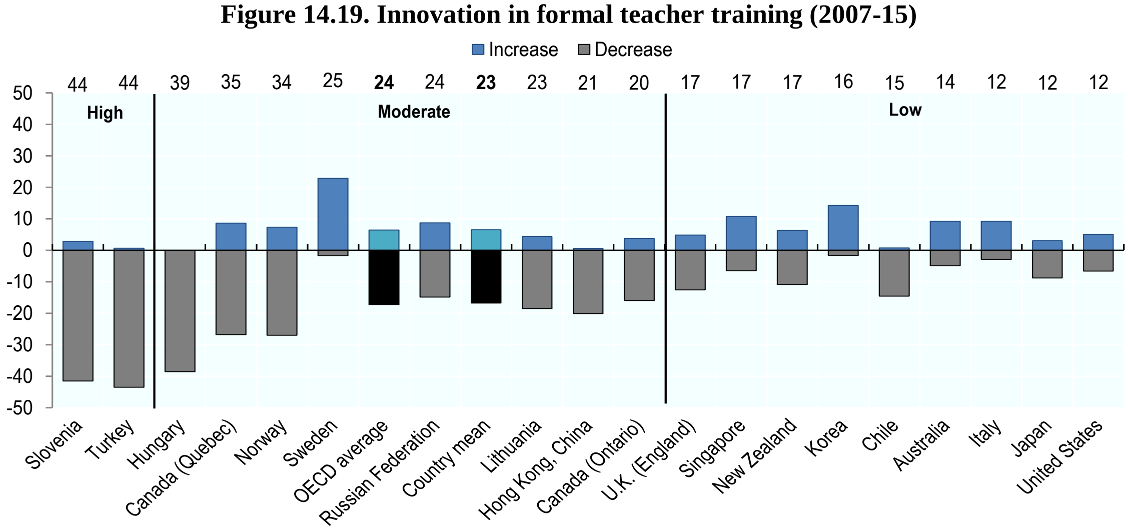
Innovation in upgrading and updating teachers' skills through formal training has been moderate over the past decade, in fact moderate-low: fewer students have been taught by teachers who had taken teacher training in their content area or in teaching their content in the past decade. Whether this is a "good" or "bad" innovation is difficult to say, as informal professional development can sometimes be as effective as formal training.

On average, the magnitude of the decreased teacher training practices overtook the increases. Only in Sweden and Korea were more students taught by teachers having taken formal teacher training. Sweden actually saw an increase in almost all practices of formal teacher training. At the other end of the spectrum, Hungary, Turkey and Slovenia witnessed large decreases, with Hungary recording increase in none of the teacher training practices covered. In Slovenia, the decrease was most pronounced in formal training for primary teachers while in Turkey, the fall was mostly due to less training by secondary teachers. In Hungary, teacher training decreased across disciplines and education levels. In many countries, teacher training remained stable over the period, with low levels of change – in fact lower than for most other areas of innovation we cover.

Drivers of change

This negative decline of teacher training was common to both secondary and primary education, both maths and science, affecting mainly teacher training about maths or science content and curriculum.

Figure 14.19. Innovation in formal teacher training (2007-15)



Note: The index synthesises innovation in teacher training practices of students. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in formal teacher training computed by summing the absolute values of increases and decreases. See Annex B for more details. For Chile (2011-2015), Korea (2011-2015), New Zealand (2011-2015) and Turkey (2011-2015) the index has been calculated for an interval different from 2007-15 due to unavailability of data.
Source: Authors' calculations based on TIMSS Databases.

StatLink https://doi.org/10.1787/888933906880

Innovation in teachers' peer learning

Innovation in teachers' peer learning: large

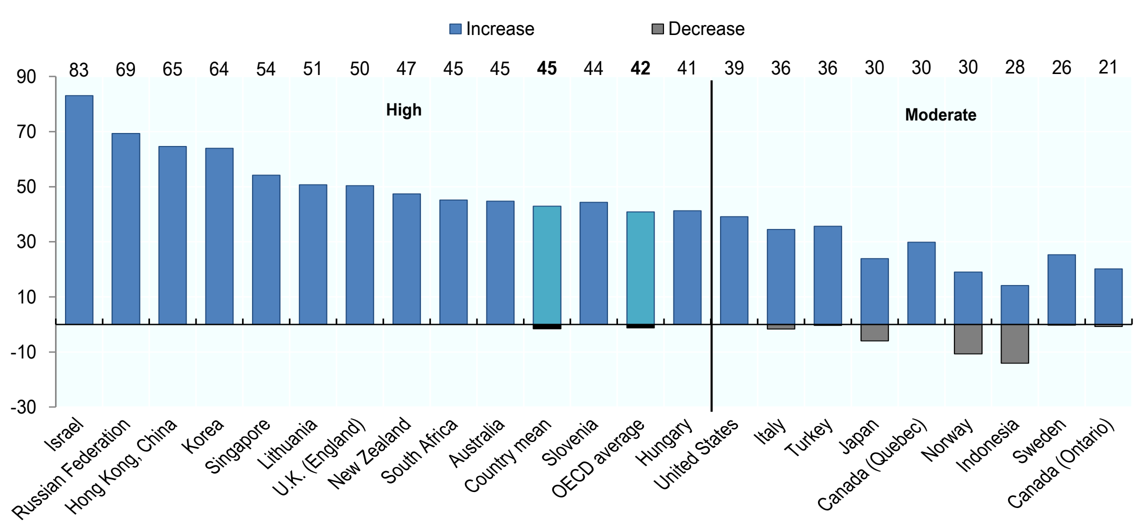
Peer learning is a strong form of professional development for teachers, often considered as more effective than formal training, partly because it is more strongly connected to teachers' needs. By coming together with their peers to discuss, collaborate or observe each other's practices, teachers develop professionally.

Contrary to formal training, which has mostly decreased, the rise of peer learning among teachers represents a large innovation on average, and at least a moderate one in all countries covered. Teachers engaged in peer learning activities taught a significantly higher share of students. In Israel, the Russian Federation, Hong Kong (China), Korea, innovation in this domain was very large, but it was also large in many other countries. In Israel, the practice skyrocketed in primary education, while in the other three most of the changes happened for secondary teachers. Indonesia and Norway are the only two countries to have seen some noticeable decrease in this practice, but all countries experienced a net increase in teacher peer learning.

Drivers of change

Innovation in this domain has been large in both primary and secondary education, but changes in the latter have typically been greater than in the former. In secondary education, the practice has spread a little more for science than maths teachers. While all peer-learning practices have increased, collaborating with other teachers to prepare instructional material increased the most both in primary and secondary education.

Figure 14.20. Innovation in teachers' peer learning (2007-15)



Note: The index synthesises innovation in peer learning practices of teachers. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in teachers' peer learning computed by summing the absolute values of increases and decreases. See Annex B for more details. For Indonesia (2007-2011), Turkey (2011-2015), South Africa (2007-2011), New Zealand (2011-2015) and Korea 2011-2015).
Source: Authors' calculations based on TIMSS Databases.

StatLink https://doi.org/10.1787/888933906899

Innovation in school external relations and human resource management (HRM)

Innovation in school external relations and HRM: moderate

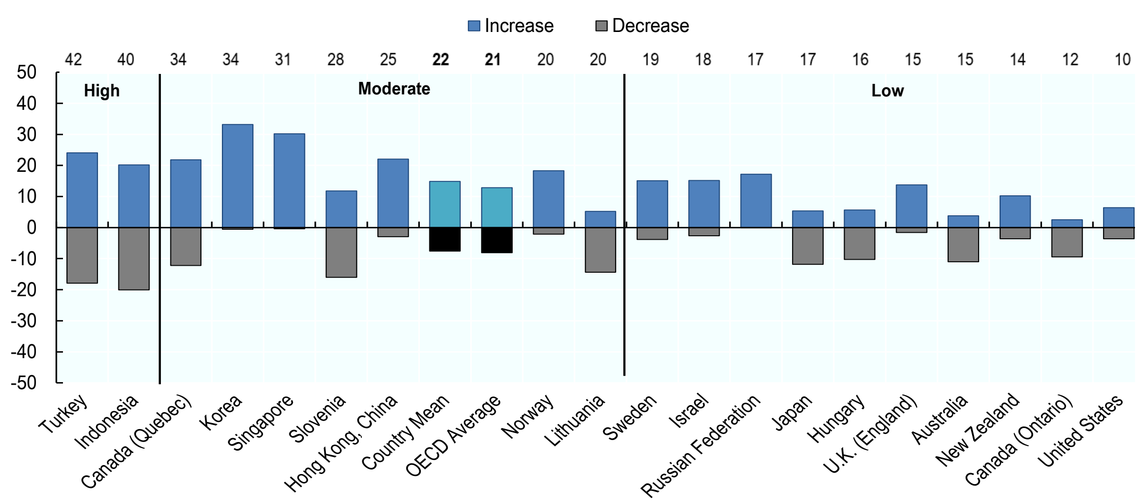
Innovation in education does not only concern pedagogical practices and resources, but also how schools relate to external stakeholders (such as parents) and their teachers. School external relations and HRM practices refer here to parental engagement (parental involvement in school activities, in helping in reading, public communication of school results) and to school practices to incentivise teachers to work and stay in the school.

Innovation in this area has been moderate in the past decade, in fact almost low. Turkey and Indonesia have experienced the most innovation in external relations and HRM practices, with positive and negative changes depending on the practices. Both countries have less used incentives to recruit or retain teachers in secondary education, while they increased the public posting and tracking of school achievement data. Parental involvement in school activities expanded in Québec (Canada), although parents were less mobilised to help in reading. Korea and Singapore have also experienced relatively large expansion of all these practices. In the United States, Ontario (Canada) and New Zealand, there was very little innovation in this area.

Drivers of the change

Innovation has been low in the HRM practices covered, with very little change in the use of incentive policies for recruiting and retaining teachers in secondary schools. Parental involvement in school activities has increased, a bit more in secondary than in primary education. Public posting and tracking of school achievement data have met modest changes as well, with different trends across education systems.

Figure 14.21. Innovation in external relations and HRM practices in schools (2006-16)



Note: The index synthesises innovation in external relations and HRM practices in schools. The magnitude can be interpreted as an average effect size (multiplied by 100): levels below 20 can be considered as small, between 20 and 39 as moderate, and over 40 as large. The value on top is the composite index in external relations and HRM practices in schools computed by summing the absolute values of increases and decreases. See Annex B for more details. For New Zealand (2011-2016) the index has been calculated for an interval different from 2006-16 due to unavailability of data
Source: Authors' calculations based on TIMSS, PIRLS and PISA Databases.

StatLink https://doi.org/10.1787/888933906918

Box 14.1. Construction of the composite indices in brief

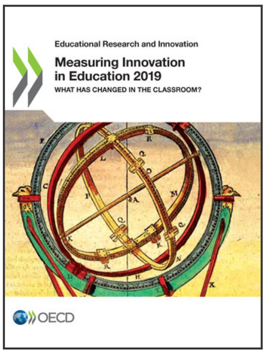
Composite indices synthesise the information of the individual practice indicators and correspond to systemic innovation in different broad areas in the covered education systems. A first set of indices proposes an aggregate measure of educational innovation in primary and secondary education altogether, and in primary and secondary separately. A second set captures innovation in the educational practices in mathematics, science, and reading. A third set of innovation indices focuses on computer availability and ICT use in schools. The fourth set of indices finally focuses on broad categories of practices related to education (pedagogical practices, teacher professional development, and school level practices). These indices are based on the same methodology, but could not be computed for all countries because of missing data. Some indices overlap, for example the technology-related indices and the indices by broad categories: they can thus not be compared directly.

A step-by-step construction of the indices followed the following process:

1. Practices were categorised under broad categories. For instance, the primary education innovation index groups all practices at that level; the homework practices index groups all practices related to homework; and so on.
2. Effect sizes were computed for every practice, quantifying the change in their use between the baseline and endline years. For every index, a weighted average of the effect sizes of its component practices was calculated. Equal weights were given to primary and secondary education while the weights for maths, science and reading reflect the relative time spent on them in terms of class hours. For instance, if maths, science and reading each are taught for 3, 4 and 3 hours a week respectively, their weights would be 0.3, 0.4 and 0.3 respectively.
3. The weighted average was multiply by a factor of 100 to reach the final composite index. By construction thus, the composite index is a positive number ranging from 0 to positive infinity. It can be interpreted as an average effect size (multiplied by 100). The higher the composite index, the higher the impact of the change in the use of the practices, and thus the innovation experienced by students in the educational system.
4. As a convention, and in line with the common interpretation of effect sizes, we refer to indices between 0 and 20 as small, between 20 and 40 as moderate, and over 40 as large. This is a continuum though.

For the indices by broad area of activity, the graphs show the final composite index as a number, while the bars highlight how much corresponded to an average expansion or contraction of the corresponding practices.

Annex B provides more about the details of the methodology adopted in the construction of the composite indices.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