2

Are there qualities unique to teachers in high-performing countries and schools?

This chapter explores PISA data to establish relationships between the success of education systems and schools in PISA and their teacher policies. The first section focuses on variation across countries, and explores system-level aspects that are common, and in some cases, unique, to high-performing countries and economies. The second section focuses on variations within countries and across time, and explores how changes in student-teacher ratios, class size, teacher compensation, and school autonomy for selecting teachers are related to performance trends across all PISA-participating countries and economies. The last section focuses on variations within countries, and explores how teachers' qualifications and experience, teacher turnover, and support for teachers' professional learning are related to school-level outcomes.

Note regarding B-S-J-G (China)
B-S-J-G (China) refers to the four PISA participating China provinces : Beijing, Shanghai, Jiangsu, Guangdong.

Note regarding CABA (Argentina)
CABA (Argentina) refers to the Ciudad Autónoma de Buenos Aires, Argentina.

Note regarding FYROM
FYROM refers to the Former Yugoslav Republic of Macedonia.

A note regarding Israel

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.

PISA results highlight large differences in students' learning outcomes across countries and schools. By linking those outcomes to data on students' background, to schools' practices, and to education systems' policies, PISA data can help identify the characteristics of schools and education systems that perform well. This chapter helps policy makers and educators learn from policies and practices applied elsewhere, by exploring what teacher-related policies are common and unique to high-performing countries and schools.

Teacher policies are a set of interventions, in a number of areas, that shape the composition of the teaching workforce and the work of teachers. They include recruitment processes, initial teacher preparation and induction policies, career and compensation structures, professional learning opportunities and requirements, and teacher-appraisal policies.

What the data tell us

- There are three elements common to high-performing countries' professional development policies for teachers: a mandatory and extended period of clinical practice as part of pre-service teacher education or of the induction period; the presence of a variety of bespoke opportunities for in-service teachers' professional development, such as workshops organised by the school; and teacher-appraisal mechanisms, either legislated or deeply rooted in school practice, with a strong focus on teachers' continuous improvement.
- On average across countries and economies participating in PISA 2006 and PISA 2015, increases in school responsibility for selecting teachers for hire were associated with improvements in students' performance in science, reading and mathematics; reductions in school responsibility were associated with declining student performance. The causal direction of this association, however, cannot be determined.
- School performance and student behaviour are positively related to teachers' average years of experience, while teacher turnover rates are negatively related to performance and behaviour, after accounting for differences in students' and teachers' demographic characteristics across schools.

Research in international education increasingly points to the role of a strong teaching workforce as a key element of a high-performing system (Darling-Hammond et al., 2017[1]; Jensen et al., 2016[2]; Jensen et al., 2016[3]; Hanushek, Piopiunik and Wiederhold, 2014[4]). Following the publication of the OECD *Teachers Matter* report, a first major study of policies for attracting, developing and retaining effective teachers in schools (OECD, 2005[5]), and at least since the publication of an influential McKinsey Report on education (Barber and Mourshed, 2007[6]), teacher policies have been identified as one key element of high-performers' success in PISA. A decade ago, the authors of that report concluded, based on the analysis of ten top-performing countries, that "three things matter most: 1) getting the right people to become teachers; 2) developing them into effective instructors; 3) ensuring that the system is able to deliver the best possible instruction for every child."

Over the past ten years, the OECD has accumulated a wealth of new data on teacher policies and teachers' working conditions, and on the performance of education systems and schools.

By expanding participation in PISA and comparing performance over time, recent PISA surveys have identified more high-performing and rapidly improving systems. Recent editions of *Education at a Glance* have developed comparative indicators on teachers' careers (OECD, 2014[7]) and teacher-appraisal systems (OECD, 2015[8]).

PISA 2015 expanded the coverage of these indicators to partner countries and economies participating in PISA, through a special system-level data collection conducted in collaboration with PISA Governing Board members and National Project Managers. And PISA 2015 distributed a questionnaire, which was optional for countries, to a sample of teachers in the schools selected for the PISA assessment (see Box 3.1 in Chapter 3). The questionnaire included information about teachers' demographic profile and working conditions, often based on questions first asked as part of the OECD Teaching and Learning International Survey (TALIS) (OECD, 2009[9]; OECD, 2014[10]).

This chapter explores PISA data at the level of education systems and, in the 20 countries and subnational jurisdictions that distributed the teacher questionnaire, at the school level, to establish relationships between the success of education systems and schools in PISA and their teacher policies. The chapter is not a systematic review of teacher policies in high-performing countries, as many aspects of these policies cannot be easily quantified or categorised with the indicators available in the PISA database and related databases. Its goal is not to develop a blueprint for teacher policies, but rather to illustrate the existing evidence and gaps, and thereby contribute to the ongoing debate about effective teacher policies.

The first section focuses on variation across countries, and explores system-level aspects that are common, and in some cases unique, to high-performing countries and economies. In this section, high-performing countries and economies are defined as those that, in PISA 2015, had an above-average share of students performing at the highest levels (Level 5 and above) in science, reading or mathematics – reflecting the ability of these systems to nurture excellence – and, at the same time, a below-average share of students who did not attain the baseline level of proficiency (Level 2) in all three subjects – reflecting the inclusive nature of these systems and their ability to assure minimum standards of learning for all. These criteria led to the selection of 17 countries and economies: Australia, Beijing-Shanghai-Jiangsu-Guangdong (China) (hereafter "B-S-J-G [China]"), Canada, Estonia, Finland, Germany, Hong Kong (China), Japan, Korea, Macao (China), the Netherlands, New Zealand, Norway, Singapore, Slovenia, Switzerland and Chinese Taipei. Two subnational jurisdictions in OECD countries that meet the above-mentioned criteria for high-performing systems, and that contribute to the system-level indicators published in the OECD's annual report, *Education at a Glance*, were also analysed: England (United Kingdom) and the Flemish Community of Belgium.

The second section focuses on variations within countries and across time, and explores how changes in student-teacher ratios, class size, teacher compensation, and school autonomy for selecting teachers are related to performance trends across all PISA-participating countries and economies. While it is conventional wisdom that change in education is slow, data from *Education at a Glance* and from school questionnaires distributed by PISA show that these are areas in which there have been significant changes over the past decade (more specifically, between 2005 or 2006 and 2015). This makes it possible to ask whether these changes have been accompanied by improvements or declines in performance.

The last section focuses on variations within countries, across schools, and explores how teachers' qualifications and experience, teacher turnover, and support for teachers' professional learning are related to performance differences in science, reading and mathematics, and to a positive school climate (as measured through the index of disciplinary climate in science lessons and the incidence of bullying at school). These analyses are restricted to the 20 countries and subnational jurisdictions that distributed the teacher questionnaire.

HOW DO HIGH-PERFORMING COUNTRIES SELECT, DEVELOP AND EVALUATE TEACHERS?

What do high-performing countries have in common? A cursory look at the list of the 19 highest-performing education systems in PISA – as defined above – shows that they span four continents, different levels of economic development, include city-states as well as some of the largest economies in the world, and have widely different histories and social and economic trajectories. Yet several influential studies that have analysed and compared some of the highest-performing countries and economies in PISA have identified common traits in their teacher policies. In addition to the already-cited McKinsey report (Barber and Mourshed, 2007[6]), more recently, a more in-depth review of seven high-performing countries and education systems[1] (Darling-Hammond et al., 2017[1]) concluded that "a key goal in all of the [seven] jurisdictions [is] to develop a strong teaching profession", "a workforce that is highly educated and empowered to make decisions about teaching for the best interests of their students".

It is also intriguing that despite their diversity, these countries and economies not only perform well in PISA; but to a large extent, teachers in these countries and economies reported feeling valued by society at large. Indeed, of the 19 highest-performing countries/economies, 13 participated in the TALIS survey in 2013-14 (for Canada, only the province of Alberta, one of the highest-performing provinces, participated). In Finland, Korea and Singapore, more than 50% of lower secondary teachers agreed, or strongly agreed, with the statement "I think that the teaching profession is valued in society"; and in seven more high-performing participants in TALIS, namely Alberta (Canada), Australia, England (United Kingdom), the Flemish Community of Belgium, New Zealand, the Netherlands, and Shanghai (China), an above-average percentage of teachers agreed with that statement. Two more countries, Japan and Norway, reported levels of agreement close to the international average of 31%. Only one high-performing country in PISA with available data – Estonia – reported low levels of agreement with the statement (14%) (OECD, 2015[11]; OECD, 2014, Table 7.3[10]).

This section takes this conclusion as the starting point to explore the PISA database and the OECD system-level database in search of common traits among a broader set of 19 high-performing countries, economies and subnational regions mentioned in the introduction. While small samples can only support tentative conclusions, this section sets out to identify institutions and practices that support teacher professionalism in high-performing countries; understanding these patterns can help other countries improve their own systems.

The data used in this section mostly come from the annual OECD publication *Education at a Glance*, and have been expanded to include OECD partner economies through a special system-level data collection conducted in 2016 in collaboration with PISA Governing Board members

and National Project Managers. Data refer to lower secondary teachers, even in countries where PISA students are no longer in lower secondary schools. This ensures that data on teacher policies remain comparable across countries, despite varying education structures. Furthermore, in all countries, lower secondary teachers are or have been a strong influence on the development of PISA 15-year-old students' knowledge and skills.

There are several limitations to these data. System-level data are often missing or difficult to access and compile for some countries where responsibility for education policy lies at the subnational level. Important nuances required to interpret these data well are also often missing when the variations in policies across countries must be reduced to a limited number of categories in order to support comparisons. Where possible, and where it was felt to be important, these data are therefore complemented with more qualitative information from in-depth reviews of these countries' policies, and with data from the Teaching and Learning International Survey (TALIS). Finally, the system-level data reflect the recent policy environment (typically, the year 2014 or 2015), and are not necessarily representative of the policies under which a majority of the teachers in 2015 were trained, selected and managed over the course of their career in teaching.

The examination of the data reveals that despite a common goal of supporting teacher professionalism, high-performing countries often use different instruments to select, develop and evaluate teachers. Career and compensation structures also differ widely across this set of countries. In fact, when requirements for entry into the teaching profession, teacher-appraisal mechanisms, and policies regarding professional development, career progression and salaries are compared across the 19 highest-performing countries and economies in PISA, the most common finding is that there are no common traits. The systems that support teachers' professional growth differ among high-performing countries; and the coherence between the different elements within a system – from initial mechanisms for selecting and preparing teachers, through to ongoing structures that provide feedback and support for professional learning and effective teaching – is greater than the coherence across countries in any single element of that continuum. Some high-performing countries, such as Finland, place greater emphasis on recruitment strategies and strong teacher preparation; others, such as Singapore, emphasise formative appraisal and in-service, collaborative professional learning (Darling-Hammond et al., 2017[1]).

Nevertheless, three aspects stand out for being common to all high-performing countries/economies for which relevant information is available.

- First, the presence of a mandatory teaching practicum as part of pre-service education, to ensure that student teachers have some classroom experience before they formally become teachers. Teacher candidates in high-performing countries typically receive extended *clinical training* to help them bridge theory and practice at the beginning of their teaching career; where the practicum included in initial teacher-preparation programmes is short, novice teachers benefit from intensive induction or mentoring programmes to support beginning teachers.
- Second, the presence of a variety of bespoke opportunities for in-service professional development, such as workshops organised by the school. This is perhaps related to the widespread autonomy of schools in selecting teachers for hire; but more than autonomy, it reflects strong capacity at the local level to lead and adapt to changing needs and conditions.

- Finally, the existence (with only one exception: Germany) of teacher-appraisal mechanisms, either legislated or deeply rooted in school practice, with a strong developmental focus. While detailed information is often missing on the specific features of some of these appraisal systems, the available evidence shows that appraisals tend to rely to a large extent on classroom observations and teacher interviews, and to be geared mostly towards teacher improvement; career progression and salary increases are at stake only in a few countries, and are sometimes handled through separate appraisal processes.

How teachers become teachers: Requirements for entry into the teaching profession

Competitive examinations to enter teaching-training programmes or to start teaching can create a more select pool of candidates and even contribute to making teaching a prestigious occupation in some countries. But in contexts where teacher shortages are a problem, such mechanisms may inadvertently discourage potentially suitable candidates from considering a teaching career. And there is hardly any discernible pattern among high-performing countries and economies in PISA in the entry requirements to become teachers – perhaps a reflection of the diversity of local contexts and challenges.

In some high-performing countries and economies, such as Finland, Hong Kong (China), Korea, Macao (China) and Chinese Taipei, candidates must pass a competitive examination to be admitted into pre-service teacher education. In Japan, the competitive examination is held later, as a condition to start teaching; and in Korea and Chinese Taipei, student teachers (who had already passed a competitive examination to enter pre-service teacher education) must pass another competitive examination to start teaching (Figure 2.1).

In other high-performing countries, including Australia, England (United Kingdom), Estonia, Norway, Singapore and Slovenia, there are no competitive examinations to enter teacher-preparation programmes or to start teaching.

The duration of teacher-training programmes, and the level of qualification (bachelor's or master's degree) attained at the end of teacher-training programmes, also vary greatly across the highest-performing countries and economies in PISA. Lower secondary teachers in the Flemish Community of Belgium have the shortest path to teaching, with just three years of teacher preparation, leading to a bachelor's degree.

The most frequent minimum duration of post-secondary studies for teacher-training programmes among high-performing countries and economies, however, is four years. In Australia, England (United Kingdom), Japan, Korea, Macao (China), the Netherlands, Norway and Chinese Taipei, this is the normal duration of initial teacher preparation for lower secondary teachers. In Singapore as well, a bachelor's degree in education is earned in four years, but graduates whose bachelor's degree is not specific to education (as is the case for the majority of new teachers) must participate in a one- or two-year postgraduate teacher-training programme (Diploma in Education). In Estonia, Finland, Slovenia and Switzerland, student teachers must study for five years to earn a master's degree; in Hong Kong (China), the five-year programme leads to a bachelor's degree. Among high-performing countries, the longest path to teaching is in Germany, where teacher preparation for lower secondary teachers typically lasts between six and seven years (and results in a master's degree), including at least one year of practicum (see below).

Figure 2.1 ■ Requirements for entry into the teaching profession

High-performing countries and economies in PISA, lower secondary general programmes, 2013

Yes
At the discretion of institutions
No
a Not applicable
m Missing

	Share of low achievers in all three subjects	Share of top performers in at least one subject (science, reading or mathematics)	Competitive examination required to enter pre-service teacher training	Teaching practicum (pre-service training) is mandatory	Competitive examination required to enter the teaching profession	Duration of teacher-training programme, in years	ISCED 2011 attainment level at the end of teacher training (6: Bachelor's or equivalent; 7: Master's or equivalent)	Credential or license required to start teaching	Credential or license required to become a fully qualified teacher
Australia	11.1	18.4				4	6 or 7		a
B-S-J-G (China)	10.9	27.7	m	m	m	m	m	m	m
Canada	5.9	22.7	m	m	m	m	m	m	m
England (United Kingdom)	9.8	18.1			a	4	7	a	
Estonia	4.7	20.4			a	5	7	a	a
Finland	6.3	21.4			a	5	7	a	a
Flemish Community (Belgium)	10.9	25.2	a		a	3	6	a	a
Germany	9.8	19.2	m		a	6.5	7	a	a
Hong Kong (China)[1]	4.5	29.3				5	6		
Japan	5.6	25.8	a			4	6		a
Korea	7.7	25.6				4	6		a
Macao (China)[2]	3.5	23.9				4	6		
Netherlands	10.9	20.0	a		a	4	6	a	a
New Zealand	10.6	20.5	m		m	m	m	m	m
Norway	8.9	17.6			a	4	6	a	a
Singapore[3]	4.8	39.1			Na	1	6		
Slovenia	8.2	18.1			a	5	7	a	
Switzerland	10.1	22.2	a		a	5	7	a	a
Chinese Taipei	8.3	29.9				4	6		

1. Duration of teacher-training programme refers to the number of years of study for Bachelor of Education (B.Ed.). graduates. However, there are candidates pursuing a one-year, full time postgraduate diploma as their pre-service teacher-training programme.

2. Reference year: 2014/15.

3. The duration of teacher-training programme refers to the Postgraduate Diploma in Education programme, which is the training received by most trainee teachers. This training is required for those whose bachelor's degree is not specific to education. The duration of other full-time initial teacher preparation programmes offered at the National Institute of Education varies according to the programme: Bachelor of Arts/Science (education) – 4 years; Diploma in Education – 1 to 2 years (depending on general or specialisation track); and Postgraduate Diploma in Education (physical education) – 2 years.

Countries and economies are listed in alphabetical order.

Source: OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education,* Tables I.2.9a, I.2.10a, B2.I.45 and B2.I.46, http://dx.doi.org/10.1787/888933433171 and http://dx.doi.org/10.1787/888933433235; OECD (2016), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools,* Tables II.6.56 and II.6.57, http://dx.doi.org/10.1787/888933436513; for New Zealand: Education Council (2010), *Approval, review and monitoring processes and requirements for Initial Teacher Education Programmes,* Wellington, Education Council.

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Certification requirements can add another layer of selection. While teacher certification, credentials and licenses offer no guarantee of excellence in teaching, they may help ensure that only the most motivated candidates progress in their career. In Australia, there are no competitive examinations to enter teacher training or start teaching, but student teachers must

earn a credential or license in order to start teaching. In most Australian jurisdictions, teachers reach the first level of accreditation upon graduation from an approved initial teacher education programme; but they must renew their registration regularly (typically, every five years), and can advance to full registration after a period of employment as teachers and an appraisal against the Australian Professional Standards for Teachers at "Proficient" level (OECD, 2013, p. 285[11]).

Other high-performing countries, including Singapore, do not restrict or control access to the teaching profession through competitions, licenses or credentials. However, teaching graduates in Singapore must successfully complete a probation period in which their competence for the job is evaluated. Singapore also specifically recruits candidates from the top third of the secondary school graduating class by offering them attractive conditions for study and work, such as a competitive monthly stipend during the training period.

More than competitive examinations, credentials or the duration of teacher-training programmes, a feature of initial teacher preparation that is common to high-performing countries and economies in PISA (except Macao [China]) is a mandatory teaching practicum as part of the pre-service education (information for B-S-J-G [China] and Canada is missing in the *Education at a Glance* database). In contrast, a teaching practicum was not always required as part of pre-service teacher training in Chile, Croatia, the Czech Republic, France, Georgia and the United States (OECD, 2016, Table II.6.56[13]). In Chile, this requirement was introduced only recently by a comprehensive reform of teacher training, teacher careers and teacher working conditions, known as *Política Nacional Docente* (National Teacher Policy), that was passed in 2016 and implemented beginning in 2017 (Ministerio de Educación, 2018[12]).

The duration of the teaching practicum provided as part of initial teacher education for lower secondary teachers is known only for some OECD countries. It ranges from 20 days in Japan and less than two months in Estonia, Korea and Slovenia, to several months in Australia, England (United Kingdom) and Norway, and to one or two full school years in Germany. However, Estonia, Japan and Korea, whose initial practicums are among the shortest, complement their practicums with mandatory induction programmes for novice teachers (OECD, 2014[7]).

Retrospective data based on teachers' reports about their initial education, collected as part of the TALIS survey in 2013-14, show that 90% of lower secondary teachers in Shanghai (China), and more than 70% of lower secondary teachers in England (United Kingdom), Japan, Korea and Singapore had taken part in a formal induction programme in their first regular employment as teachers – compared to an average of 50% across all countries participating in TALIS in 2013-14 (Table 2.16) (OECD, 2015[13]).

All high-performing countries recognise that beginning teachers need intensive support to apply their knowledge to teaching, and to develop professional networks with more experienced mentors. In other words, extended clinical training in the form of a pre-service practicum or a well-mentored induction programme helps teachers in high-performing countries bridge the gap between theory and practice.

The way in which requirements for clinical practice are actually met matter at least as much as their duration for the quality of student-teachers' learning. To help teachers move from theory to practice (and from practice to reflection) at the beginning of their teaching career, it is important

that their classroom practice is enriched with timely and precise feedback, and that the field experience is not disconnected from coursework in teacher education (OECD, 2005[5]). Extended periods of clinical practice, well-supported by mentors and by instructors, during which future teachers gain experience in a broad range of professional tasks, require significant resources. The example set by high-performing systems shows that investing in these resources up front, by attracting, training and supporting good teachers, rather than at the back end, by reducing attrition and firing weak teachers, might have greater payoffs for students (Schleicher, 2011[14]).

School autonomy for selecting teachers

In many school systems in OECD countries and elsewhere, recent decades have seen a general trend towards decentralisation, with responsibilities for budget management, staffing, school buildings, teaching content and processes, and the organisation of learning given to intermediate levels of government and, to a large extent, to schools themselves. Underlying this trend is the idea that education systems need to adapt to rapidly changing conditions, and that local actors are often best placed to identify these changes and the required adjustments.

But this trend also presents challenges in governing education systems: complex, decentralised systems often struggle with lack of leadership capacity at the local level, shared responsibilities across multiple levels, inadequate accountability structures, and the need for mechanisms to align local decisions with more centrally determined strategies (Burns and Köster, 2016[15]). Analyses based on PISA 2012 data, for example, showed that schools with greater autonomy for resource allocation performed worse than otherwise similar schools in their country, on average, except in countries with strong public accountability of schools (those in which all, or almost all schools, posted student achievement data publicly) (OECD, 2013, pp. 52-53[16]).

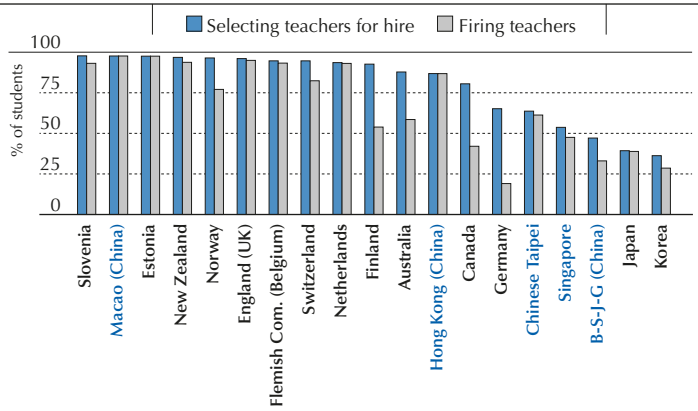
While there are a diversity of governance structures and traditions among high-performing countries, many of those countries outside of East Asia have decentralised systems for selecting or allocating teachers to schools.

In 13 of the 19 highest-performing countries/economies, over 80% of 15-year-old students attended schools whose principal or school governing board has considerable responsibility for selecting teachers for hire (OECD average: 74%), with most of the exceptions to this pattern found among high-performing East Asian systems. In Germany and Chinese Taipei, about two-thirds of the students attended schools with autonomy in selecting teachers for hire; in Singapore, 54% of students, and in B-S-J-G (China), Japan and Korea, less than 50% of students attended such schools (Figure 2.2).[2]

In many countries, school responsibility for firing teachers is less common than school responsibility for selecting teachers for hire. In particular, in Australia, Canada, Finland and Germany, a significantly smaller share of principals reported having a considerable role in decisions about firing teachers than reported having such a role in hiring teachers. Overall, in 9 of the 19 highest-performing countries and economies, over 80% of students attended schools whose principal or school governing board has considerable responsibility for firing teachers; while in 6 other countries, less than 50% of students attended such schools.

Figure 2.2 ■ **School responsibility for selecting teachers**

Percentage of 15-year-old students in schools where the principal or school governing board has considerable responsibility for hiring or firing teachers, based on principals' reports; high-performing countries and economies in PISA



Countries and economies are ranked in descending order of the percentage of students in schools where the principal or the school governing board has considerable responsibility for selecting teachers for hire.

Source: OECD PISA 2015 Database, Table 2.8.

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School responsibility for hiring and firing teachers is common in Nordic, Anglo-Saxon, and Eastern European countries, even among lower-performing education systems. These countries are characterised by public sector employment that is "position-based" (OECD, 2005[5]), i.e. where public services tend to focus on selecting the best-suited candidate for each position, whether by external recruitment or internal promotion. In contrast, school autonomy for hiring and firing teachers tends to be less common in France and in South European countries, such as Greece, Italy, Portugal (at least for firing teachers) and Spain, as well as in Latin American countries (with the exception of Chile) and, as already noted, in East Asian systems. These countries are characterised by public sector employment that is "career-based" (OECD, 2005[5]), i.e. where public services tend to recruit based on academic credentials or a civil service entry examination, and once recruited, teachers are allocated to positions according to rules that operate at the system level. In PISA 2015, the percentage of students who attended schools with considerable responsibility for selecting teachers for hire was positively, but only moderately, related to mean performance in science ($r = 0.36$ across all countries; $r = 0.40$ across OECD countries).[3]

Professional development requirements and participation

Like many other professionals, teachers need to stay abreast of what is new in their field and be able to respond to the emerging demands of their job, which is why many countries make professional development mandatory. Among high-performing countries and economies, in Hong Kong (China) and Korea, participation in professional development is compulsory for teachers in order to obtain a promotion or salary increase. It is a requirement for maintaining employment in Australia, England (United Kingdom), Estonia, Finland, Germany, Japan and Slovenia. Such requirements translate into high participation rates in professional development programmes in most of these countries (OECD, 2016, Table II.6.17[13]).

Figure 2.3 ■ **Professional development requirements for teachers**

High-performing countries and economies in PISA, lower secondary general programmes, 2013

Yes
No
a Not applicable
m Missing

	Share of low achievers in all three subjects	Share of top performers in at least one subject (science, reading or mathematics)	Professional development is a compulsory requirement for teachers to maintain employment	Professional development is a compulsory requirement for promotion or salary increase
Australia	11.1	18.4	Yes	No
B-S-J-G (China)	10.9	27.7	m	m
Canada	5.9	22.7	m	m
England (United Kingdom)	9.8	18.1	Yes	No
Estonia	4.7	20.4	Yes	No
Finland	6.3	21.4	Yes	No
Flemish Community (Belgium)	10.9	25.2	No	No
Germany	9.8	19.2	Yes	No
Hong Kong (China)	4.5	29.3	No	Yes
Japan	5.6	25.8	Yes	No
Korea	7.7	25.6	No	Yes
Macao (China)[1]	3.5	23.9	No	No
Netherlands	10.9	20.0	No	No
New Zealand	10.6	20.5	m	m
Norway	8.9	17.6	No	No
Singapore	4.8	39.1	No	No
Slovenia	8.2	18.1	Yes	No
Switzerland	10.1	22.2	m	m
Chinese Taipei	8.3	29.9	No	No

1. Reference year: 2014/15.

Countries and economies are listed in alphabetical order.

Source: OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education,* Tables I.2.9a, I.2.10a, B2.I.45 and B2.I.46, http://dx.doi.org/10.1787/888933433171 and http://dx.doi.org/10.1787/888933433235; OECD (2016), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools,* Table II.6.57, http://dx.doi.org/10.1787/888933436513.

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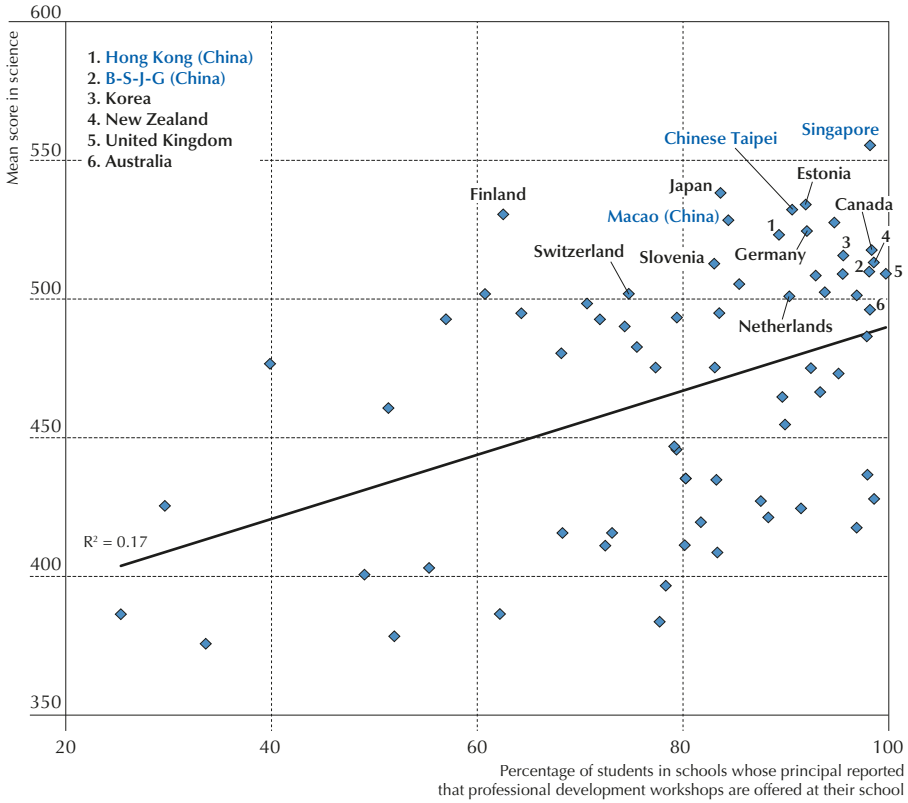
In PISA 2015, principals of schools attended by 15-year-old students were asked what proportion of their teaching staff had participated in professional development activities during the three months prior to the PISA test. Australia, England (United Kingdom) and Singapore were among the countries/economies in which school principals reported that over 80% of teachers had participated in professional development activities, on average (OECD, 2016, Tables II.6.17 and B2.II.42 [13]). Principals in B-S-J-G (China), Canada, Macao (China) and New Zealand reported between 70% and 80% participation, on average, significantly above the OECD average of 51%; in several Canadian provinces, including British Columbia and Alberta, participation rates were above 80%. Among the 19 highest-performing countries and economies in PISA, in the Flemish Community of Belgium, Germany, Japan, Norway and Slovenia principals reported below-average participation in professional development activities.

Participation rates in professional development activities, as reported by principals, were positively related to a country's performance in the PISA 2015 science test (the linear correlation

coefficient is r = 0.40 across all 69 countries/economies with comparable data; r = 0.36 across OECD countries). But the type of professional development activity matters at least as much, if not more, than participation. Performance in science is positively related to the proportion of students in schools that organise in-house professional development activities: inviting specialists to conduct trainings (r = 0.49 across all countries/economies; r = 0.56 across OECD countries), organising workshops that deal with specific issues that the school faces (r = 0.41 across all countries; r = 0.46 across OECD countries) or organising workshops for specific groups of teachers (r = 0.42 across all countries/economies; r = 0.50 across OECD countries).

Figure 2.4 ■ **School-based professional development workshops and science performance**

Based on principals' reports, PISA 2015



Note: Countries/economies named on the chart are the high-performing countries and economies in PISA analysed in this chapter.

Source: OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, Table I.2.3, http://dx.doi.org/10.1787/888933433171; OECD (2016), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools*, Tables II.6.20, http://dx.doi.org/10.1787/888933436513.

StatLink http://dx.doi.org/10.1787/888933740250

Indeed, in almost all 19 high-performing systems examined here, at least 80% of PISA-participating students were in schools that organise in-service workshops that deal with specific issues faced by the school (OECD average: 80%) or that organise in-service workshops for specific groups of teachers (OECD average: 69%). These kinds of bespoke in-service workshops were almost universally available in schools attended by 15-year-olds in Australia, B-S-J-G (China), England (United Kingdom), Korea,[4] New Zealand and Singapore; and only slightly less common in the Flemish Community of Belgium, Canada, Estonia, Germany, Hong Kong (China), Japan, Macao (China), the Netherlands, Portugal, Switzerland and Chinese Taipei(where between 70% and 95% of students were in schools that organise such workshops). Such school-based workshops are somewhat less common in Finland, Norway and Slovenia (OECD, 2016, Tables II.6.20 and B2.II.43[13]).

The advantage of school-based workshops, compared to attending a lecture by an external specialist, might come from the peer-learning opportunities they provide, and the fact that feedback and ideas from other experienced teachers in the same school are more directly related to concrete and common challenges in the classroom. The *Teachers Matter* report (OECD, 2005[5]) notes that the most effective forms of professional development focus on clearly articulated priorities, provide ongoing school-based support to classroom teachers, and create opportunities for teachers to observe, experience and try new teaching methods. Effective professional development includes opportunities for teachers to observe, design, perform or expose teaching practices, provides adequate time and follow-up support, and encourages the development of teachers' learning communities (Barrera-Pedemonte, 2016, pp. 19-25[17]).

Desimone (2009[18]) identified five core features of effective professional development activities: they are focused, embedded in collective practice, provide opportunities for active learning, tend to be longer in duration, and are coherent with wider policies and with the knowledge and beliefs of teachers who participate. A recent review of existing research similarly concludes that "activities that are intensive, sustained, collaborative, and focused on materials and problems of practice [have] more impact on teachers' knowledge, classroom practices and student achievement" (Opfer, 2016, p. 7[19]). The same author also analyses TALIS data to show that greater participation in school-embedded professional development is associated with greater reported impact of professional development on teaching knowledge and practice, while participation in professional development activities outside of the school is associated with less reported impact (Opfer, 2016, p. 17[19]).

School workshops and one-to-one coaching or mentoring programmes offer natural settings for productive forms of professional development, although effective professional development might also happen outside of the school or by pooling resources across schools.

Teacher appraisal

Monitoring and appraising teachers is central to the continuous improvement of schooling. Teachers need feedback on their performance to help them identify how to better shape and improve their teaching practice and, with the support of engaged school leadership, develop schools as professional learning communities. Teacher appraisal also provides opportunities to recognise and reward effective teaching. Based on the existing research and in-depth analyses

of numerous teacher-appraisal systems internationally, a recent OECD review concluded that "that there is no single model or global best practice of teacher appraisal"; however, the report provided a number of policy suggestions for improving teacher appraisal, including (OECD, 2013[11]):

- establishing teaching standards to guide teacher appraisal and professional development
- resolving tensions between the developmental and accountability functions of teacher appraisal
- conducting regular developmental appraisals at the school level, based on multiple sources of evidence, including frequent classroom observations conducted by competent evaluators internal to the school
- ensuring that teacher appraisal feeds into professional and school development
- establishing periodic career-progression appraisal involving external evaluators
- preparing teachers for appraisal processes and strengthening the capacity of school leaders for teacher appraisal.

Almost every high-performing country and economy in PISA has a legislated policy of teacher appraisal for lower secondary teachers, as does nearly every lower-performing country and economy. Twelve out of 17 high-performing systems for which data are available for 2015 have a legislated appraisal system for lower secondary teachers. Australia, Canada, England (United Kingdom), the Flemish Community of Belgium, Japan, Korea, Macao (China), the Netherlands, New Zealand, Singapore, Slovenia and Switzerland have national or state laws or regulations in place to regulate one or more types of teacher appraisal.

Countries/economies that have no policy framework about teacher appraisal, such as Estonia, Hong Kong (China), Norway and Chinese Taipei, nevertheless have similar practices that cover a large proportion, if not all, teachers. In Hong Kong (China), for example, the Education Bureau requires all schools to develop their own performance-appraisal system for teachers. In Norway, approaches to teacher appraisal are not regulated nationally, but are typically designed at the local and/or school level, and all teachers are appraised. The only exception among high-performing countries is Germany, which has no legislated teacher appraisal policy (data for B-S-J-G [China] and Finland are missing; teacher-reported information from TALIS can be used to complement system-level data about these two systems) (Figure 2.5).

In Shanghai (China), all lower secondary teachers are in schools that conduct formal appraisals, according to principals' reports; and 98% of lower secondary teachers reported in TALIS that they had received regular formal or informal feedback on their performance and areas for development in their current school. Feedback following classroom observation is particularly widespread (96%) (Table 2.16).

In Finland, in contrast, there is no national policy framework for teacher appraisals; rather, the basis for teacher appraisal is defined in the contract between the local government that employs the teacher and the teachers' trade union. Under these contracts, school principals, who are seen as the pedagogical leaders of the school, typically conduct annual discussions aimed at appraising the teacher's fulfilment of individual objectives set up during the previous year and

determining developmental needs for the following year (OECD, 2013, p. 290[11]). Nevertheless, in 2013, although 74% of Finnish lower secondary teachers were in schools whose principals reported that teachers are formally appraised, as many as 36% of teachers reported that they had not received any formal or informal feedback on their performance and areas for development in their current school – one of the highest percentages among countries participating in TALIS (Table 2.16)

Figure 2.5 ■ **Teacher appraisal**
High-performing countries and economies in PISA, lower secondary general programmes, 2015

Yes
No
a Not applicable
m Missing

	Share of low achievers in all three subjects	Share of top performers in at least one subject (science, reading or mathematics)	Existence of legislated teacher appraisal	Percentage of teachers appraised	Type of appraisal covered by policy framework (if legislated)			Frequency of mandatory, regular appraisals (every ... years)
					Regular appraisal	Appraisal for promotion	Appraisal for reward schemes	
Australia	11.1	18.4		m		m		1
B-S-J-G (China)	10.9	27.7	m	m	m	m	m	m
Canada[1]	5.9	22.7		m	m	m	m	m
England (United Kingdom)[2]	9.8	18.1		90				1
Estonia[3]	4.7	20.4		80	a	a	a	a
Finland	6.3	21.4	m	m	m	m	m	m
Flemish Community (Belgium)	10.9	25.2		m				4
Germany	9.8	19.2		a	a	a	a	a
Hong Kong (China)[4]	4.5	29.3		100	a	a	a	a
Japan	5.6	25.8		m				m
Korea	7.7	25.6		m				1
Macao (China)[2]	3.5	23.9		100				
Netherlands	10.9	20.0		68				3
New Zealand	10.6	20.5		100				1
Norway[3]	8.9	17.6		m	a	a	a	a
Singapore	4.8	39.1		100				0.5
Slovenia	8.2	18.1		100				1
Switzerland	10.1	22.2		m	m	m	m	m
Chinese Taipei[3]	8.3	29.9		a	a	a	a	a

1. Appraisal is legislated in most, but not all, Canadian provinces.
2. Teacher appraisal is legislated in public institutions, and not legislated (but widely practised) in private institutions.
3. Teacher appraisal is not legislated, but similar practices exist.
4. The Education Bureau requires all schools to have a fair and open performance appraisal system for teachers. Schools should develop their own school-based appraisal system in consultation with teachers.

Countries and economies are listed in alphabetical order.

Source: OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, Tables I.2.9a, I.2.10a, B2.I.45 and B2.I.46, http://dx.doi.org/10.1787/888933433171 and http://dx.doi.org/10.1787/888933433235; OECD (2016), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools*, Tables II.4.47 and II.4.49, http://dx.doi.org/10.1787/888933436498.

StatLink http://dx.doi.org/10.1787/888933740269

Among the remaining countries with available data, Iceland, Luxembourg and Scotland (United Kingdom) similarly do not have a legislated teacher-appraisal system. Some 43% of lower secondary teachers in Iceland reported (in TALIS) that they had not received any feedback in their current school.

Ten of the 12 high-performing countries and economies with a legislated policy framework for teacher appraisal conduct regular appraisals of teachers. Data for Canada and Switzerland are missing, as different provinces and cantons might have different provisions. Regular appraisals are typically organised at the school level and pursue a mix of purposes, including professional development and establishing teachers' responsibilities and working conditions. The key aspect of such appraisals is that they feed into individual and collective professional development.

Among the remaining participants in PISA with a legislated framework for teacher appraisal, Ireland, Israel, Italy and Spain do not have regulations in place for regular appraisals (OECD, 2016, Table II.4.49[13]). In Spain, only appraisals for teacher registration are covered by the policy framework; each region is responsible for the evaluation and appraisal of its teachers. But TALIS and PISA both indicate that teachers have limited opportunities to receive feedback, based on classroom observation, about their teaching (OECD, 2015[20]). In Italy, only appraisals at the completion of the probationary period are mandated, although a recent reform has established a merit-based component of teachers' salaries that will require the regular appraisal of teacher performance by school-led teacher evaluation committees (OECD, 2017[21]).

The periodicity of regular appraisals can vary widely across countries and economies. In the Flemish Community of Belgium, teachers receive mandatory, periodic appraisals every four years, the longest interval observed across all countries; in the Netherlands, every three years; in Australia, England (United Kingdom), Korea, Macao (China), New Zealand and Slovenia, every year; and in Singapore, twice a year (the frequency of regular appraisals was not reported by B-S-J-G [China], Canada and Japan).

In addition, in five of these countries/economies teachers can receive appraisals as part of reward schemes or when applying for promotion. In Canada, although there is some variation across jurisdictions, there are typically two processes for regular appraisal: teachers' performance is typically appraised every five years (or more frequently if there are concerns about performance), but teachers are also more frequently appraised for their professional development (OECD, 2013[11]).

Where regular teacher appraisals exist, and the information about the aspects appraised and the sources of information used for appraisals is available (eight countries/economies), the policy framework always specifies that the instructional core of teachers' work (planning and preparation, instruction, and the classroom environment) is appraised. This is also the case in all remaining countries that conduct regular appraisals and provided information. In seven countries/economies (all countries with available information except Korea), teachers' participation in professional development activities is also considered (Figure 2.6).

The essence of teaching is displayed in the classroom. This is why appraisals are typically based on classroom observations and on an interview or dialogue between the teacher and evaluators. Seven countries provided this information; only in Korea are interviews not used as an information source. Self-appraisals and teacher portfolios are also frequently used. No high-performing country

conducts teacher tests, and only two – England (United Kingdom) and Singapore – specify that information about student outcomes must be used as one of the sources for the regular assessment of lower secondary teachers. Even if it is not a formal requirement, in all TALIS-participating countries and in all schools whose principals reported that teachers are formally appraised, a large majority of principals reported that the analysis of students' test scores informs teacher appraisal, along with classroom observations and interviews (OECD, 2014, p. 355[10]).

Figure 2.6 ■ **Features of regular teacher appraisals**

High-performing countries and economies in PISA, lower secondary schools, 2015

Yes
No
a Not applicable
m Missing

	Share of low achievers in all three subjects	Share of top performers in at least one subject (science, reading or mathematics)	Aspects appraised		Instruments and information sources used					
			Planning and preparation, instruction, classroom environment	Professional development	Classroom observation	Interview/dialogue between teachers and evaluators	Teacher self-appraisal	Teacher portfolio	Teacher testing	Student outcomes
Australia	11.1	18.4							m	m
B-S-J-G (China)	10.9	27.7	a	a	a	a	a	a	a	a
Canada	5.9	22.7	m	m	m	m	m	m	m	m
England (United Kingdom)	9.8	18.1								
Estonia	4.7	20.4	a	a	a	a	a	a	a	a
Finland	6.3	21.4	m	m	m	m	m	m	m	m
Flemish Community (Belgium)	10.9	25.2			m		m	m	m	m
Germany	9.8	19.2	a	a	a	a	a	a	a	a
Hong Kong (China)	4.5	29.3	a	a	a	a	a	a	a	a
Japan	5.6	25.8	m	m	m	m	m	m	m	m
Korea	7.7	25.6								
Macao (China)	3.5	23.9								
Netherlands	10.9	20.0	m	m	m	m	m	m	m	m
New Zealand	10.6	20.5								
Norway	8.9	17.6	a	a	a	a	a	a	a	a
Singapore	4.8	39.1								
Slovenia	8.2	18.1								
Switzerland	10.1	22.2	m	m	m	m	m	m	m	m
Chinese Taipei	8.3	29.9	a	a	a	a	a	a	a	a

Countries and economies are listed in alphabetical order.

Source: OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, Tables I.2.9a, I.2.10a, B2.I.45 and B2.I.46, http://dx.doi.org/10.1787/888933433171 and http://dx.doi.org/10.1787/888933433235; OECD (2016), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools*, Tables II.4.46 and II.4.52, http://dx.doi.org/10.1787/888933436498.

StatLink http://dx.doi.org/10.1787/888933740288

In contrast, teacher tests are the only source of information for regular appraisals in Mexico, and they are also conducted in Chile, Peru and the United Arab Emirates. In Portugal, self-appraisals are the only source of information for regular appraisals. In Brazil and Colombia, classroom observation is also not practiced for regular appraisals, which are informed by student outcomes

in addition to interviews and self-appraisals or portfolios (OECD, 2016, Table II.4.52[13]). This is problematic because teacher appraisals can ensure that individual weaknesses are identified and addressed with suitable professional development activities only if the appraisal includes classroom observations. Teaching is at the core of a teacher's professional responsibilities, and can and should be directly observed (OECD, 2013[11]).

The consequences of teacher appraisals vary more widely, even among high-performing countries and economies with legislated, regular appraisals. Some countries, such as Korea, use separate processes for decisions about career and salaries, and for decisions about teachers' professional development (OECD, 2013, p. 287[11]). But most countries combine accountability and developmental functions in a single process.

In all eight high-performing countries where the information is available, appraisals are used, to some extent, for teachers' professional development. In some cases, such as in Australia, Macao (China), New Zealand and Singapore, the appraisal systematically results in a professional development plan for teachers; in others, such as Korea, a negative rating (underperformance) results in compulsory training. In England (United Kingdom), the Flemish Community of Belgium and Slovenia, the results of teacher appraisal are less formally linked to professional development, but are expected to influence professional development activities (Figure 2.7). Among the remaining countries with regular appraisal systems, in Malta, Qatar, Thailand and Turkey, teachers' professional development is not informed by appraisal results (OECD, 2016, Table II.4.52[13]).

In most cases, teachers' career advancement is at stake in regular appraisals, either because appraisal results – both positive and negative – influence decisions about promotion or the speed at which a teacher progresses through the career structure or salary scale (Australia, Macao [China], Singapore, Slovenia), or because underperformance can result in deferred promotions or career advancement (the Flemish Community of Belgium, Macao [China], New Zealand, Singapore and Slovenia). Results of regular appraisals are not formally linked to career advancement in Japan, nor does Japan conduct special appraisals for promotion. In England (United Kingdom), the results of regular appraisals are also not formally linked to career advancement, but in 2013, 97% of principals in lower secondary schools reported that the results of formal teacher appraisals influence the likelihood of career advancement (Table 2.16).

Teachers' salaries are directly dependent on the results of regular appraisals only in Singapore, where a salary increase is provided, in the form of a pay allowance, for good performance. In Australia, England (United Kingdom), Macao (China), New Zealand and Slovenia, the impact on pay is a reflection of the influence of appraisals on career progressions. In the Flemish Community of Belgium, Japan and Korea, the results of regular teacher appraisals are not used for determining pay levels, although in Korea, there is a separate performance-based incentives system under which teachers are obliged to be appraised annually (OECD, 2013[11]).

Based on in-depth analysis of the existing literature and the review of over 20 teacher-appraisal systems across the world, a recent OECD report highlighted that it is not the existence of formal appraisal requirements, but the design and quality of the processes that matter most if teacher appraisals are to have an impact on teaching and learning outcomes (OECD, 2013[11]).

Figure 2.7 ■ **Use of results from regular teacher appraisals**

High-performing countries and economies in PISA, lower secondary level, 2015

Yes
No
a Not applicable
m Missing

	Share of low achievers in all three subjects	Share of top performers in at least one subject (science, reading or mathematics)	Use of results for professional development			Use of results for career advancement		Use of results for pay levels			
			Appraisal systematically results in a professional development plan	Appraisal is expected to influence professional development activities	Underperformance results in compulsory training	Appraisal results influence decisions about promotion or the speed at which a teacher progresses through the career structure or salary scale	Underperformance results in deferral of promotion or career advancement	Appraisal results affect the base salary	A pay allowance is provided for good performance	Appraisal affects pay levels to the extent that it affects progression through the career structure and/or salary scale	A salary increment is withheld in case of underperformance
Australia	11.1	18.4					m				
B-S-J-G (China)	10.9	27.7	a	a	a	a	a	a	a	a	a
Canada	5.9	22.7	m	m	m	m	m	m	m	m	m
England (United Kingdom)	9.8	18.1									
Estonia	4.7	20.4	a	a	a	a	a	a	a	a	a
Finland	6.3	21.4	m	m	m	m	m	m	m	m	m
Flemish Community (Belgium)	10.9	25.2			m						
Germany	9.8	19.2	a	a	a	a	a	a	a	a	a
Hong Kong (China)	4.5	29.3	a	a	a	a	a	a	a	a	a
Japan	5.6	25.8	m	m	m		m				m
Korea	7.7	25.6									
Macao (China)	3.5	23.9									
Netherlands	10.9	20.0	m	m	m	m	m	m	m	m	m
New Zealand	10.6	20.5									
Norway	8.9	17.6	a	a	a	a	a	a	a	a	a
Singapore	4.8	39.1									
Slovenia	8.2	18.1									
Switzerland	10.1	22.2	m	m	m	m	m	m	m	m	m
Chinese Taipei	8.3	29.9	a	a	a	a	a	a	a	a	a

Countries and economies are listed in alphabetical order.

Source: OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, Tables I.2.9a, I.2.10a, B2.I.45 and B2.I.46, http://dx.doi.org/10.1787/888933433171 and http://dx.doi.org/10.1787/888933433235; OECD (2016), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools*, Table II.4.55, http://dx.doi.org/10.1787/888933436498.

StatLink http://dx.doi.org/10.1787/888933740307

Recent literature, based on data from Cincinnati (United States), where teachers are appraised through multiple detailed classroom observations and a review of teachers' work products, has shown that teachers become more effective in promoting student test achievement in post-evaluation years. This suggests that the feedback received during evaluation and the professional development activities undertaken in response help teachers develop new skills or work to improve critical areas (Taylor and Tyler, 2012[22]).

Teachers' salaries and factors that influence teachers' careers and salaries

Higher salaries can help school systems attract more candidates to the teaching profession, and signal that teachers are regarded and treated as professionals. In general, in most high-performing countries and economies for which data are available, teachers earn salaries that are higher than the per capita GDP. The exceptions, among countries with available data, are Macao (China) and Norway, although teachers' salaries in Macao (China) are nevertheless significantly above the OECD average, in real terms (Figure 2.8). But several lower-performing countries also compensate teachers well; and, as seen above, high salaries are not universal among high-performing countries (OECD, 2016, Table II.6.54[13]). It is therefore important to look at other aspects of teacher compensation, including how salary progressions are linked to career structures.

Out of the 19 high-performing countries and economies considered in this section, 11 provided responses on the importance given to various aspects of teaching in determining teachers' career progression and salaries. The relative importance of four factors was investigated: appraisal results (where appraisals are conducted), taking on extra roles and tasks, participation in professional development, and length of service. Results vary greatly across the 11 countries (Figure 2.8).

In Korea, Slovenia and Chinese Taipei, all four factors (three in Chinese Taipei, where there are no teacher appraisals) were rated as equally important for teachers' career progression; but in Korea, length of service has a stronger influence on teachers' salaries than the other factors. In Macao (China) and Singapore, teacher-appraisal results were reported as the major determinant of teachers' career progression and salaries, together with taking on extra roles and tasks (the latter, however, has only a weak influence on salaries in Singapore). In England (United Kingdom) and New Zealand, in contrast, length of service, and taking on extra roles and tasks, were reported as stronger influences on teachers' careers and salaries than teacher-appraisal results, or the participation in professional development which, in England, has no influence at all (Figure 2.8).

In Estonia, taking on extra roles and tasks has the biggest influence on teachers' career progression, while salaries are also influenced to a similar extent by appraisal results (appraisal is conducted by the school management; there is no legislated framework for appraisal). In the Flemish Community of Belgium, length of service has no influence on career progression, but is the only determinant of teachers' salaries. Similarly, in Germany, career progressions are mainly determined by teachers taking on extra roles and tasks, or completing professional development; but salaries depend, to a similar or even larger extent, on length of service (Figure 2.8).

In Australia, length of service has a strong influence on teachers' pay and career progression, while the influence of other factors was not reported (Figure 2.8). But the results of teacher appraisals were reported to influence decisions about promotion and/or progression on the salary scale (Figure 2.7). Similarly, in the Netherlands, the length of service is a strong determinant of teachers' salaries, while the influence of other factors was not reported (Figure 2.8).

Principals' responses to the PISA school questionnaire can also be used to assess the extent to which schools are responsible for determining teachers' salaries, either by establishing starting salaries or by determining the timing or amount of salary increases. In most high-performing countries outside of East Asia, schools have considerable responsibility for selecting teachers for hire; but that does not imply that these teachers are employed and paid directly by schools or that their

employment is not regulated at a more central level. In fact, only in England (United Kingdom), Hong Kong (China), Macao (China) and the Netherlands did more than 50% of students attend schools whose principal or school governing board enjoys considerable responsibility for setting starting salaries for teachers. And only in England (United Kingdom), Estonia, Macao (China) and the Netherlands can a majority of schools (weighted by the student population) determine teachers' salary increases. In the remaining high-performing countries and economies, even where schools are responsible for selecting teachers through hiring and/or firing decisions, teachers' salaries and salary increases are set outside of the school boundaries (Table 2.8).

Figure 2.8 ■ **Factors that influence teachers' salaries and career progression**

High-performing countries and economies in PISA, lower secondary schools, 2015

High
Moderate
Low
No influence at all
a Not applicable
m Missing

	Share of low achievers in all three subjects	Share of top performers in at least one subject (science, reading or mathematics)	Factors that influence teachers' career progression: Teacher appraisal results	Taking on extra roles and tasks	Completion of professional development	Length of service	Factors that influence teachers' salaries: Teacher appraisal results	Taking on extra roles and tasks	Completion of professional development	Length of service	Teachers' salaries after 15 years of experience for teachers with typical training (2014): Teachers' salaries in equivalent USD converted using PPPs (in thousands)	Ratio of salaries to per capita GDP (2014)
Australia	11.1	18.4	m	m	m		m	m	m		57	1.2
B-S-J-G (China)	10.9	27.7	m	m	m	m	m	m	m	m	m	m
Canada	5.9	22.7	m	m	m	m	m	m	m	m	66	1.5
England (United Kingdom)	9.8	18.1									46	m
Estonia	4.7	20.4									m	m
Finland	6.3	21.4	m	m	m	m	m		m		43	1.0
Flemish Com. (Belgium)	10.9	25.2									49	m
Germany	9.8	19.2									69	1.5
Hong Kong (China)	4.5	29.3	m	m	m	m	m	m	m	m	90	1.6
Japan	5.6	25.8	m	m	m	m	m	m	m	m	49	1.4
Korea	7.7	25.6									47	1.4
Macao (China)	3.5	23.9									121	0.9
Netherlands	10.9	20.0	m	m	m	m	m	m	m		66	1.4
New Zealand	10.6	20.5									44	1.2
Norway	8.9	17.6	m	m	m	m	m	m	m	m	44	0.7
Singapore	4.8	39.1									107	1.3
Slovenia	8.2	18.1									38	1.3
Switzerland	10.1	22.2	m	m	m	m	m	m	m	m	m	m
Chinese Taipei	8.3	29.9	a				a				30	1.3

Countries and economies are listed in alphabetical order.

Source: OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, Tables I.2.9a, I.2.10a, B2.I.45 and B2.I.46, http://dx.doi.org/10.1787/888933433171 and http://dx.doi.org/10.1787/888933433235; OECD (2016), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools*, Tables II.4.57, II.6.54 and II.6.59, http://dx.doi.org/10.1787/888933436498 and http://dx.doi.org/10.1787/888933436513; OECD (2016), "Indicator D3 How Much are Teachers Paid?", in *Education at a Glance 2016: OECD Indicators*, http://dx.doi.org/10.1787/eag-2016-31-en.

StatLink http://dx.doi.org/10.1787/888933740326

Overall, it appears that teacher compensation levels and the rules governing teachers' careers differ significantly not only across countries in general, but among the more restricted set of high-performing countries and economies as well. A forthcoming thematic report on human resources, part of the OECD School Resources Review project, will analyse best practices governing compensation and benefits.

WHAT SYSTEM-WIDE CHANGES IN TEACHER CHARACTERISTICS AND PRACTICES ARE RELATED TO IMPROVEMENTS IN STUDENT PERFORMANCE AT THE COUNTRY LEVEL?

This section focuses on changes in teacher characteristics and teacher policies within countries, across time. Cross-country associations that are discussed in the first section and are confirmed by within-country patterns of association examined in this second section can be said to be robust. Indeed, these within-country patterns show not only that countries with certain characteristics perform better or worse, on average, but they help ascertain whether performance improved or deteriorated in countries that, through purposeful reforms or other means, changed their teacher policies or characteristics.

The analysis has several limitations. First, data on teacher policies or characteristics that can be compared both across time and across countries are extremely limited: for many of the characteristics noted above, and particularly for the three common traits of high-performing systems cited above – clinical training, bespoke professional development, and formative teacher appraisal – no trend data are available.

Furthermore, although the focus on within-country variations fully accounts for country-level characteristics that remained constant over the period, and which might drive cross-country associations, the causality of the relationships, and which change is the cause and which the effect, might remain unclear. For example, it might be that the perception of deteriorating performance was used to justify reforms in governance, rather than the reforms causing the declines in performance.

Finally, few countries saw significant changes in performance between 2006 and 2015, and the statistical uncertainty around changes in PISA performance can make it more difficult to detect a relationship even where one exists.

Despite these limitations, three conclusions emerge from this analysis:

- System-level changes in the net flow of teachers in and out of the profession, as reflected in student-teacher ratios, in class size, and in hiring flows indicated by the share of teachers under the age of 30, are, in general, unrelated to improvements in PISA performance. However, countries that reduced the incidence of grade repetition tended to limit teacher flows into the profession, perhaps indicating that the reduction in grade repetition rates was motivated at least in part by budget concerns, and that these savings were not totally reinvested in alternative measures to assist low-performing students.
- Changes in teachers' salaries are also unrelated to improvements in performance among countries participating in PISA.

- The only variable that shows some association with system-level improvements or deterioration in performance is the increase in school autonomy for selecting teachers for hire, or for firing teachers. This relationship is stronger across systems in which school-level achievement data are used for accountability practices – e.g. are posted publicly or are tracked over time by an administrative authority.

Most trends in teacher policies and characteristics cover the period between 2006 and 2015 (when based on PISA school-questionnaire data) or between 2005 and 2015 (when based on the annual OECD publication *Education at a Glance*). They are systematically compared to contemporary trends in performance, and sometimes in attainment, between PISA 2006 and PISA 2015. While all three domains in PISA – science, reading and mathematics – can be compared between these dates, the most robust comparison is based on science performance, which was the major domain in both assessments. Associations with science performance trends are therefore highlighted in the text, with the remaining two domains used to verify the robustness of these associations.

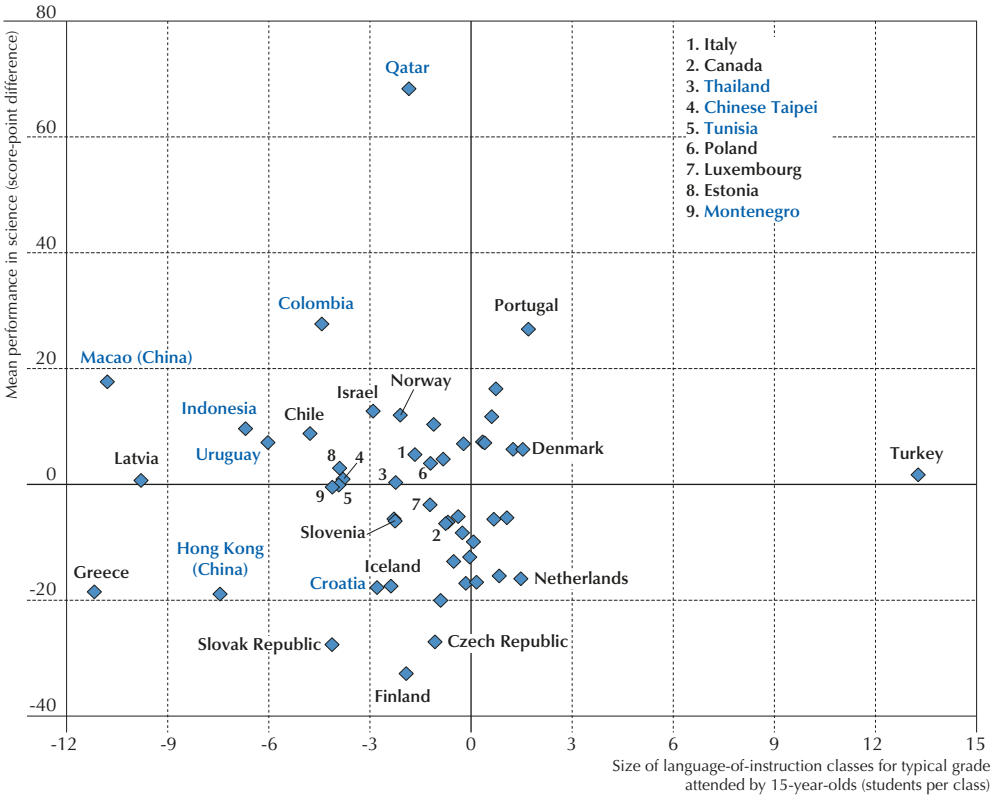
Changes in teacher quantity

Education systems must determine how many teachers are required to offer an adequate education to their students. In order to reduce class size or lighten teachers' teaching load (and increase the amount of time teachers spend preparing lessons or participating in mentoring or professional development activities), for example, the number of teachers per student must increase – or, equivalently, the student-teacher ratio must shrink, unless these changes are compensated for by changes in students' instruction time or in teachers' working time. Student-teacher ratios and, indirectly, class size, also have a considerable impact on the level of expenditure on education.

Smaller classes are often seen as beneficial, because they allow teachers to focus more on the needs of individual students and reduce the amount of class time needed to deal with disruptions. While reducing class size is a costly measure, there is some evidence that smaller classes benefit students in the primary grades in particular (Chetty et al., 2011[23]; Piketty and Valdenaire, 2006[24]; Fredriksson, Öckert and Oosterbeek, 2013[25]), while the evidence is more scant and less certain for lower- and upper-secondary grades (Bouguen, Grenet and Gurgand, 2017[26]; Wößmann and West, 2006[27]).

Class size has been consistently measured in PISA by asking school principals to report the average size of language-of-instruction classes for the typical grade attended by 15-year-old students (also known as the "modal" grade). Across 51 countries/economies with comparable results for 2006 and 2015, changes in average class size were not significantly related to learning trends in science (r = -0.01) or in any PISA domain. The correlation with student-teacher ratios was also low (r = .13), and the positive sign indicates that some of the fastest-improving countries in PISA – such as Portugal and Qatar – had actually reduced, rather than increased, the number of teachers per student (i.e. increased the student-teacher ratio) (Figue 2.9 and Figure 2.10).

Figure 2.9 ■ **Change between 2006 and 2015 in average class size and science performance**



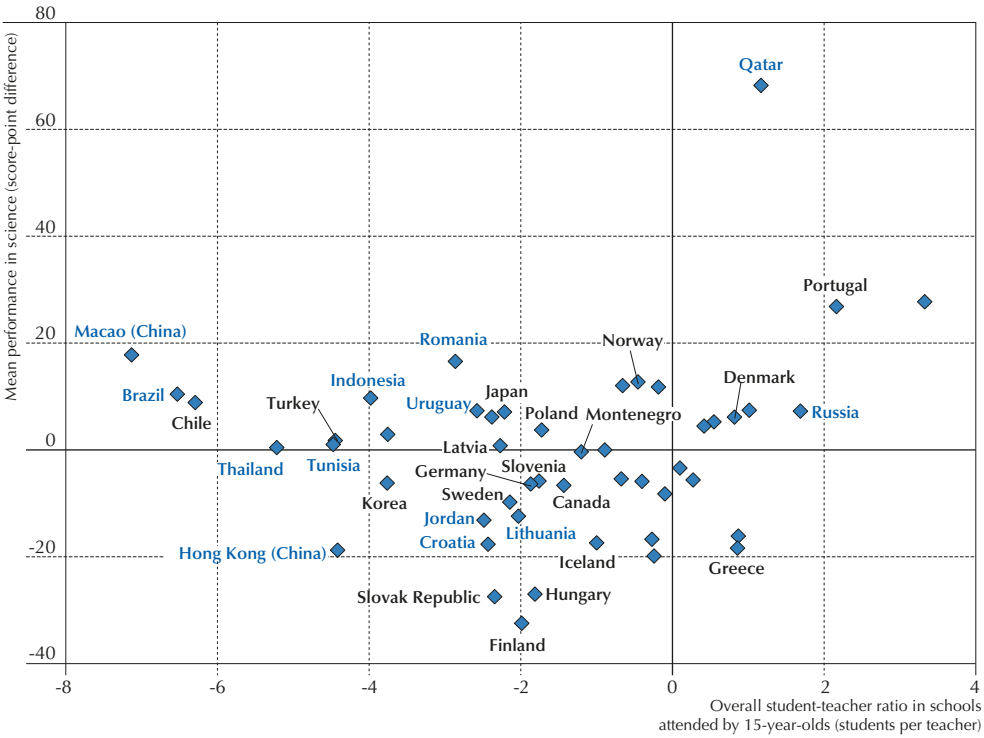
Note: Countries/economies named on the chart show a significant change in average size of language-of-instruction classes between 2006 and 2015. Countries/economies with non-significant changes are Australia, Austria, Belgium, Brazil, Bulgaria, Germany, Hungary, Japan, Jordan, Lithuania, Mexico, New Zealand, Romania, Russia, Spain, Sweden, Switzerland, the United Kingdom and the United States.

Source: OECD PISA 2015 Database, Table 2.7; OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, Table I.2.4a, http://dx.doi.org/10.1787/888933433171.

StatLink http://dx.doi.org/10.1787/888933740345

In fact, other data seem to suggest that countries with high rates of grade repetition, and therefore large proportions of students enrolled in lower grades than is typical for their age, such as France and Portugal, were able to reduce the demand for teachers significantly as they reduced the grade-repetition rate. There is indeed a positive correlation between a reduction in the proportion of students whose progress from one grade to the next is delayed and a reduction in the share of teachers under the age of 30 across the 25 OECD countries with available data (r = 0.39). This is apparent in France and Portugal, for example, while the opposite pattern – an increase in the share of students who are held back a grade, and a greater inflow of young teachers – is observed in Chile (Figure 2.11).

Figure 2.10 ■ **Change between 2006 and 2015 in the student-teacher ratio and science performance**



Note: Countries/economies named on the chart show a significant change between 2006 and 2015 in the overall student-teacher ratio in schools attended by 15-year-olds. Countries/economies with non-significant changes are Australia, Belgium, Bulgaria, Colombia, the Czech Republic, Ireland, Israel, Italy, Luxembourg, Mexico, the Netherlands, Spain, Switzerland, Chinese Taipei, the United Kingdom and the United States.

Source: OECD PISA 2015 Database, Table 2.1; OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education,* Table I.2.4a, http://dx.doi.org/10.1787/888933433171.

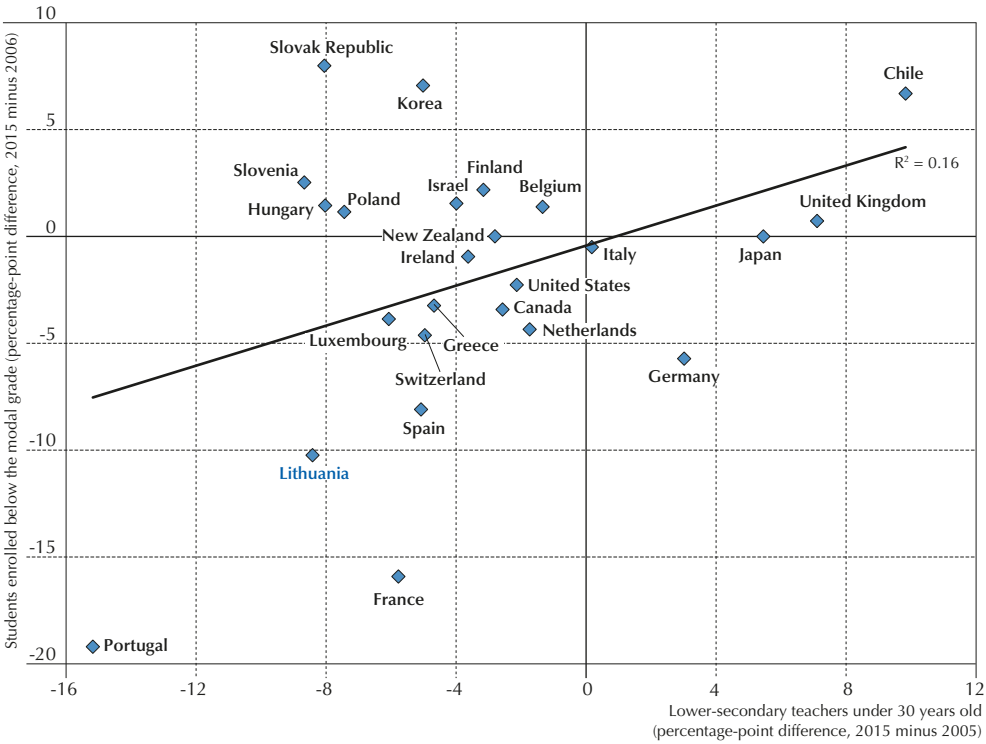
StatLink http://dx.doi.org/10.1787/888933740364

These concurrent trends might indicate that the reduction in grade-repetition rates resulted in lower expenditure on wages for teachers, because the savings accrued when students spend fewer years in primary and lower-secondary school were not entirely reinvested in teacher-led measures to assist low-performing students.

Changes in teacher certification and salaries

There are no valid and reliable indicators for the quality of a country's teacher workforce that can be compared over time and across countries. Even proxies, such as teachers' experience and qualifications, which are included in the OECD education databases, often cannot be compared over time. PISA trends in performance can be compared to simultaneous trends in the share of fully certified teachers and in teachers' statutory salaries, which are sometimes considered to be proxies for teacher quality.

Figure 2.11 ■ **Change between 2005 and 2015 in grade repetition and the inflow of young teachers**



Source: OECD PISA 2015 Database, Table 2.15; OECD (2016), *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools*, Table II.5.5, http://dx.doi.org/10.1787/888933436509.

StatLink http://dx.doi.org/10.1787/888933740383

But the evidence linking higher salaries to greater average quality or effectiveness of teachers is mixed. Reviews of studies based on the variation of salaries within countries tend to find that teachers' salaries are, at best, weakly related to teacher quality (Hanushek and Rivkin, 2006[28]; Hanushek, 2006[29]). However, Dolton and Marcenaro-Gutierrez (2011[30]) find that, over the period 1995-2006, the variation in teachers' salaries across countries and over time is positively related to achievement differences and growth in international assessments of student performance. Salaries might also influence the attractiveness of the teaching profession and thereby the skills profile of future teachers (Leigh, 2012[31]) (also see Chapter 4).

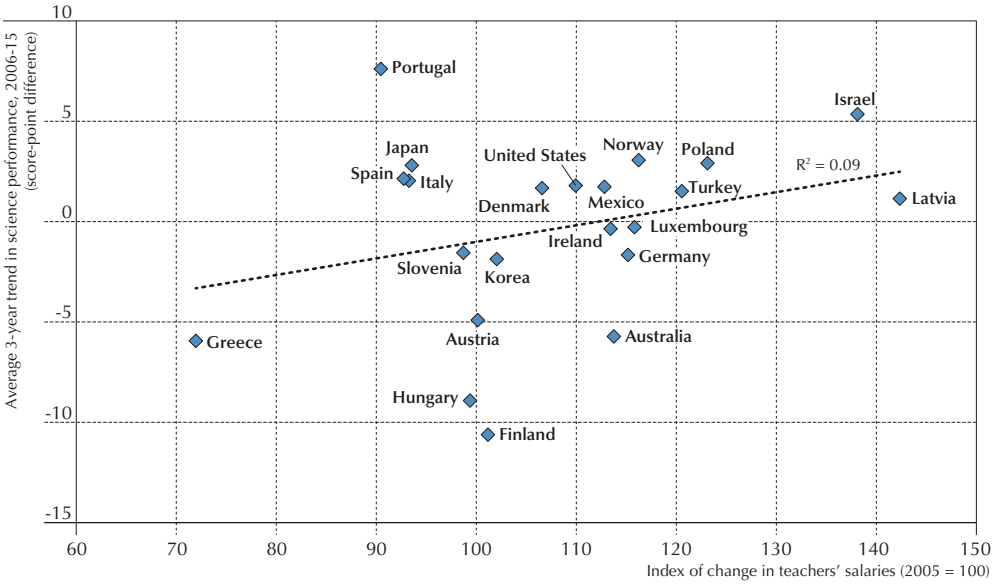
Similarly, while certified teachers can be expected to constitute a more select pool of teachers, evidence from the United States shows that certification can be unrelated to teachers' effectiveness (Kane, Rockoff and Staiger, 2008[32]). Changes in certification rates over time might reflect changes in the standards used for certification, more than changes in the quality of teachers. Therefore, country-level changes in salaries or certification rates might not necessarily reflect changes in the average quality of current teachers.

Changes in teachers' salaries over time might, in fact, be accompanied by improvements or deteriorations in average teacher quality. Some countries might wish to increase teachers' statutory salaries in order to attract better candidates to the teaching profession; but it might take several years before the effects of such a policy are reflected in student outcomes. Other countries might be tempted to raise teachers' salaries in reaction to increased competition from other sectors. That might help retain teachers in the profession, but it cannot fully prevent a reduction in the average quality of the teacher workforce.

Among OECD countries with available data, changes between 2005 and 2015 in teachers' statutory salaries were weakly related to learning trends in science between PISA 2006 and PISA 2015 (r = 0.29). Teachers' salaries increased by 20% or more in Israel, Latvia, Poland and Turkey between 2005 and 2015; only in Israel did science performance improve significantly between 2006 and 2015. Meanwhile, teachers' salaries decreased by more than 20% in Greece – where performance in science also declined – and by about 10% in Portugal – where performance in science improved significantly (Figure 2.12).

Changes in the proportion of fully certified teachers are also unrelated to trends in performance. In two of the fastest-improving countries – Colombia and Qatar – the proportion of fully certified teachers swung in opposite directions, perhaps due to changes in certification requirements.

Figure 2.12 ■ **Trends in teachers' salaries and science performance**



Note: The horizontal axis shows the change between 2005 and 2015 in teachers' statutory salaries after 15 years of experience, in public, general, lower secondary institutions, based on typical qualification levels, converted to constant prices using deflators for private consumption.

Source: OECD PISA 2015 Database, Table 2.14; OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, Table I.2.4a, http://dx.doi.org/10.1787/888933433171.

StatLink http://dx.doi.org/10.1787/888933740402

In Colombia, only about 10% of teachers were reported to be fully certified in PISA 2012 and PISA 2015, while more than 80% were so reported in PISA 2006 and PISA 2009; in Qatar, the share increased from 41% in 2006 to 75% in 2015.[5] Most countries saw smaller variations in the proportion of fully certified teachers across the PISA cycles, and these variations are only weakly related to improvements or deterioration in students' PISA performance (Table 2.4).

Changes in school autonomy for hiring and firing teachers

Of the many aspects of teacher policies considered in the first section, the only aspect for which PISA has systematically collected data that can be compared over time is the extent to which schools are responsible for hiring and firing teachers.

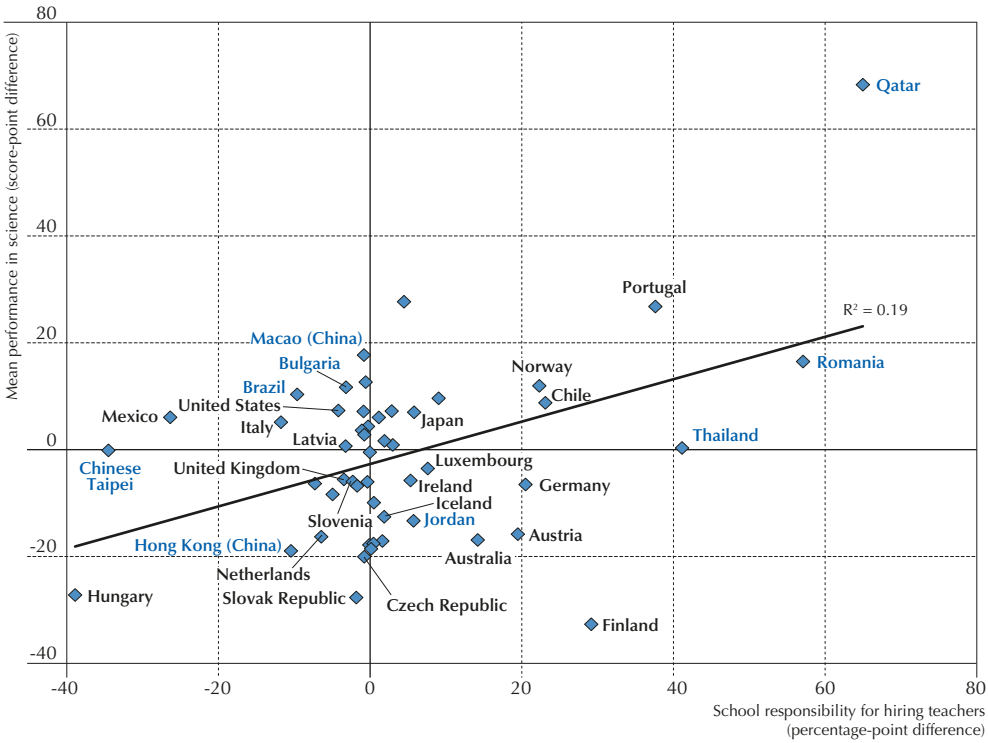
The proportion of students who attend schools whose principal or school governing board has considerable responsibility for selecting teachers for hire increased by more than 40 percentage points between 2006 and 2015 in Qatar, Romania and Thailand, and by between 20 and 40 percentage points in Chile, Finland, Germany, Norway and Portugal. Meanwhile, the proportion of students attending schools that have considerable responsibility for firing teachers, e.g. because they are underperforming or for other reasons, increased by a similar amount (over 50 percentage points) in Qatar and Romania, and increased by between 20 and 30 percentage points in Denmark, Finland and Norway (Table 2.8). Over the same period, Norway, Portugal, Qatar and Romania saw significant improvements in science performance, while results remained stable in Denmark, Germany and Thailand, and mean performance deteriorated in Finland.[6]

In some countries, school autonomy in hiring and firing teachers became less common between 2006 and 2015. In Hungary, where performance declined, and in Chinese Taipei, where performance remained stable, the proportion of students attending schools whose principal reported considerable responsibility for selecting teachers for hire decreased by more than 30 percentage points, as did the proportion of students attending schools with considerable responsibility for firing teachers. Autonomy for hiring teachers also declined in Mexico (-26 percentage points), where science performance remained stable (Table 2.8).

Overall, across all 51 countries/economies with comparable data, improvements in science performance tended to be associated with increases in school autonomy for hiring ($r = 0.44$) and firing ($r = 0.46$) teachers. The relationship remains significant, but weaker ($r = 0.32$), after excluding the two countries with the fastest improvement (Qatar) and decline (Finland) in student performance (How do the best-performing schools support teachers' work?).

In fact, the relationship between changes in school responsibilities for managing teachers and changes in performance appears to be moderated by the extent to which schools, in a particular country, were held accountable for their students' results in 2015. In Finland, Germany, Hungary, Mexico and Chinese Taipei, in 2015 a smaller percentage of 15-year-old students than on average across OECD countries attended schools where achievement data such as graduation rates or a school's average test results are posted publicly or tracked over time by administrative authorities (Table 2.11); and changes in school responsibilities between 2006 and 2015 were not related to changes in performance, on average across these countries. In contrast, in Chile, Denmark, Norway, Portugal, Qatar, Romania and Thailand, such accountability practices were at least as common, in 2015, as on average across OECD countries; and increases in school autonomy between 2006 and 2015 had often been accompanied by improvements in performance.

Figure 2.13 ■ **Change between 2006 and 2015 in school responsibility for hiring teachers and science performance**



Notes: Countries/economies named on the chart show a significant change between 2006 and 2015 in the percentage of 15-year-old students in schools whose principal or school governing board has considerable responsibility for selecting teachers for hire. Countries/economies with non-sigificant changes are Belgium, Colombia, Croatia, Denmark, Estonia, Greece, Israel, Korea, Montenegro, New Zealand, Poland, Russia, Spain, Sweden, Switzerland, Tunisia, Turkey and Uruguay.
The horizontal axis shows the difference, between 2015 and 2006, in the percentage of 15-year-old students in schools whose principal or the school governing board has considerable responsibility for selecting teachers for hire.
Source: OECD PISA 2015 Database, Table 2.8; OECD (2016), *PISA 2015 Results (Volume I): Excellence and Equity in Education*, Table I.2.4a, http://dx.doi.org/10.1787/888933433171.
StatLink http://dx.doi.org/10.1787/888933740421

HOW DO THE BEST-PERFORMING SCHOOLS SUPPORT TEACHERS' WORK?

By focusing on system-wide policies and practices, the previous sections have indirectly highlighted the important role that schools play in shaping the composition and work of teachers in high-performing and rapidly improving countries. Most schools in high-performing countries, for example, enrich the professional learning of teachers with bespoke opportunities for professional development, and instructional leaders play an important role in formative teacher-appraisal processes. Furthermore, countries that have devolved greater responsibility to schools to select teachers for hire have seen greater improvements in PISA, on average, than countries that have moved towards more centralised systems.

Successful teacher policies rely on multi-layered governance where there is sufficient capacity at the local level to adapt the delivery of education to rapidly changing and increasingly diverse local contexts, within a strong coherent framework for promoting teacher professionalism (e.g. through more centralised selection and accreditation mechanisms or through school-evaluation processes).

This section looks at what happens at the school level, and, in particular, how differences in teacher characteristics and in the ways in which teachers' work is supported relate to school performance. To do so, the chapter looks beyond the highest-performing countries in PISA to include in the analysis all countries and economies that distributed an optional questionnaire to teachers in PISA-participating schools (see Box 3.1 in Chapter 3).[7] This includes OECD countries Australia, Chile, the Czech Republic, Germany, Italy, Korea, Portugal, Spain and the United States, and partner countries and economies Brazil, B-S-J-G (China), Colombia, the Dominican Republic, Hong Kong (China), Macao (China), Malaysia, Peru, Chinese Taipei and the United Arab Emirates. An international average, based on all countries and economies with available data, excluding Malaysia,[8] is often used as a reference to guide the discussion. Within the United States, the states of Massachusetts and North Carolina also participated in PISA with separate samples (representative of public schools) and distributed the teacher questionnaire. Their estimates are reported, but not included in the international average (which does include the overall estimate for the United States).

In order to explore the factors that are associated with a school's performance and climate, three series of multi-level models of increasing complexity were estimated. The first model is a so-called "empty model", which estimates the share of variation that lies within and between schools for each outcome variable considered. In the two other models, student- and school-level determinants are successively added at the appropriate level of analysis to account for this variation. The second model introduces demographic and socio-economic controls to explore the extent to which differences in student and teacher composition are at the root of between-school differences. The last model introduces three variables that relate to teachers' working conditions within their schools: teachers' turnover rate and the principals' transformational leadership practices (reported by teachers); and the number of different in-house professional development activities organised by the school (reported by the principal). The findings from each model are discussed in the following sections.

Variation in performance and learning climate across schools

Six cycles of PISA data have shown that, in most countries, the variation in the mean performance of schools is at least as large as the variation between the best-performing and the lowest-achieving countries. Every country has some schools that perform significantly better than the average school, and differences in student composition explain only part of this variation. When considering all students who participated in PISA 2015, 22% of the variation in their results lies between countries/economies, but a full 26% of the variation, on average, lies within countries, between schools (OECD, 2016, Figure II.7.1[13]).

When considering only countries/economies that collected data from teachers themselves about who they are and how they are supported in their work at school, about one-third of the variation in performance among students within each country lies between schools, and two-thirds lie

within schools (Table 2.18) – a similar proportion as observed across all PISA-participating countries, on average. The proportion of the overall variation that lies between schools is larger in B-S-J-G (China), the Czech Republic, Germany and Italy – countries where 15-year-old students are sorted into different grades and/or school tracks, depending on their prior performance. The average between-school variation in performance (expressed as a standard deviation) amounts to 50 score points – meaning that, on average, about one out of six schools in every country scores more than 50 points above the mean, and one out of six schools scores more than 50 points below the mean. The between-school standard deviation varies from over 70 score points in B-S-J-G (China) to only about 31 score points in Spain.

The importance of "school effects" – the extent to which schools differ in student outcomes – is also apparent in PISA variables measuring the extent to which the climate at school is conducive to learning. Two indices were chosen to indicate a positive school climate: the index of disciplinary climate in science lessons, and the index of exposure to bullying.

The index of disciplinary climate was constructed from students' reports on how often ("every lesson", "most lessons", "some lessons", "never or hardly ever") the following happened in their science lessons: Students don't listen to what the teacher says; There is noise and disorder; The teacher has to wait a long time for students to quiet down; Students cannot work well; Students don't start working for a long time after the lesson begins.[9] (Higher values of the index correspond to reports of a better classroom climate in science lessons.) In the analysis, the measure of disciplinary climate in science lessons is used as a proxy measure of the typical classroom climate in the school, irrespective of the subject.

Student exposure to bullying is a composite measure of the frequency ("Never or almost never"; "A few times a year"; "A few times a month"; or "Once a week or more") with which students reported that the following things happened to them at school in the 12 months prior to the PISA test: Other students left me out of things on purpose; Other students made fun of me; I was threatened by other students; Other students took away or destroyed things that belonged to me; I got hit or pushed around by other students; Other students spread nasty rumours about me. Higher values on the index correspond to greater exposure to bullying (more varied or more frequent bullying victimisation). Both indices were standardised to have a standard deviation of one across all students, on average.

Both measures showed significant variation not only across students within schools, but also, on average, between schools – meaning that they captured some aspects of the school climate, not just differences in individual students' perception of it. However, perhaps because self-reports are subjective (what is perceived negatively as "noise and disorder" by one student might be perceived positively, as liveliness, by another, for example), the between-school variation was typically a smaller fraction of the overall variation than for more precisely and objectively measured performance.

On average across 18 countries and economies, about one tenth (9%) of the overall variation in students' reports of disciplinary climate in science lessons lies between schools (Table 2.20), as does about 3.4% of the overall variation in reports of exposure to bullying (Table 2.19). This lower percentage might reflect the variety, across schools, of subjective frames of reference

that students adopt when considering a behaviour as threatening or aggressive. It might also reflect the fact that being a victim of bullying is a student-level construct (in schools with a high prevalence of bullying, for example, there might be only a few victims of bullies), while the questions on disciplinary climate explicitly aim to measure the same situation through multiple respondents, even though the particular classes that constitute students' reference point when answering the question might differ across respondents. Interestingly, countries where reports of the classroom climate in science lessons vary the most across schools are not necessarily the same countries where performance varies the most. In Australia and Spain, for example, student performance varied relatively little across schools, reflecting the absence of student sorting by ability prior to the age of 15; but students' reports about the disciplinary climate in class varied as much as on average across countries.

How student and teacher composition relate to school success

A main determinant of a schools' performance in science, and of the average school climate reported by students, is the demographic and socio-economic makeup of the student population. For example, schools with more advantaged students, on average (as indicated by higher average levels of the PISA index of economic, social and cultural status) perform better than schools that have larger concentrations of disadvantage; and within each school, more-advantaged students tend to perform better than their less-advantaged peers.

In most countries, and on average across countries, schools with larger proportions of girls tend to perform better in science even though within schools, girls typically score below boys in science, on average. The share of girls in a school is also a major determinant of the school climate reported by students. Students in schools with larger proportions of girls report a better classroom climate and less exposure to bullying (and girls report a better disciplinary climate, and are less exposed to bullying, compared to boys within the same school) (Tables 2.21, 2.22 and 2.23).

But teacher demographic characteristics are also significantly associated with better performance and school climate, on average across countries that distributed the teacher questionnaire. In particular, two characteristics were added to the model to account for the variation in teacher characteristics across schools: the proportion of fully certified teachers in the school, as reported by school principals, and the average years of experience in the teaching profession, reported by teachers in the same school (Figure 2.14).

In a majority of countries/economies, as well as on average across countries, schools with more experienced teachers tended to have better results in the PISA science test and a better school climate, as reported by students, even after accounting for student demographic characteristics. Average years of experience had a significant, positive association with science performance in the Czech Republic, Italy, the United Arab Emirates and the United States, as well as across countries, on average. The association was not significant in other countries, perhaps because years of experience also reflects cohort effects (reforms in teacher preparation and certification might mean that more recent graduates from teacher training institutions are better prepared than older graduates). Lack of significance might also reflect a small sample size, at the school level, which limits the ability to distinguish weak associations from statistical noise; only moderate and strong associations are detected (Figure 2.14).

Figure 2.14 ■ **How teacher characteristics relate to school performance and climate**

After accounting for student characteristics and for schools' socio-economic profile; results based on multi-level models

Positive relationship
Negative relationship
NS Relationship is not significant
One or more variables are missing; the relationship could not be estimated

	Index of exposure to bullying (based on students' reports)		Index of disciplinary climate in science lessons (based on students' reports)		Student performance in science	
	Share of fully certified teachers	Average years of experience among teachers	Share of fully certified teachers	Average years of experience among teachers	Share of fully certified teachers	Average years of experience among teachers
Average-18	NS				NS	
Australia	NS	NS	NS	NS	NS	NS
Brazil	NS		NS	NS		NS
B-S-J-G (China)	NS	NS		NS		NS
Chile		NS		NS		NS
Colombia	NS	NS	NS	NS		NS
Czech Republic	NS			NS		
Dominican Republic		NS		NS		NS
Germany	NS	NS	NS	NS	NS	NS
Hong Kong (China)	NS					NS
Italy					NS	
Korea	NS	NS	NS		NS	NS
Macao (China)		NS		NS		NS
Peru	NS	NS	NS	NS	NS	NS
Portugal	NS	NS	NS	NS	NS	NS
Spain	NS	NS	NS	NS	NS	NS
Chinese Taipei	NS	NS	NS	NS	NS	NS
United Arab Emirates	NS		NS			
United States	NS	NS	NS		NS	
Massachusetts			NS	NS	NS	NS
North Carolina			NS	NS	NS	NS

Note: Results based on multi-level models, including controls for students' gender, socio-economic status, immigrant background and language spoken at home, as well as for schools' average socio-economic profile and share of female students. Three distinct models were estimated for performance in science, disciplinary climate and bullying. Only countries/economies that distributed the optional teacher questionnaire are included in the analysis. Results for Malaysia are not reported, as the sample may not be representative.

The Average-18 does not include Massachusetts and North Carolina.

Countries and economies are listed in alphabetical order.

Source: OECD PISA 2015 Database, Tables 2.21, 2.22 and 2.23.

StatLink http://dx.doi.org/10.1787/888933740440

The positive association between teaching experience and both performance and school climate suggests that teacher quality and effectiveness is positively related to average teacher experience. There is significant evidence in the research literature to show that average teacher effectiveness tends to increase with years of experience – both because teachers gain valuable skills on the job and through formal professional development opportunities (Wiswall, 2013[33]; Papay and Kraft, 2015[34]; Kraft and Papay, 2014[35]; Jackson, Rockoff and Staiger, 2014[36]). In addition, the least-effective teachers tend to quit teaching more than more-effective teachers do, creating a more select pool of teachers (Hanushek, 2006[29]; Hanushek, Rivkin and Schiman, 2016[37]).

But as with other associations, the relationship established between average years of teaching experience and school results or climate is not necessarily causal. In fact, the association might result from a reverse causality: novice teachers might be disproportionately assigned to underperforming schools initially and, perhaps due to rules that give more experienced teachers a priority to choose where to teach, more experienced teachers might choose or be chosen to work in schools that perform above their expected level because of some other resource that is not fully captured by the demographic and socio-economic controls included in the analysis.

In contrast, the proportion of fully certified teachers is not related to school performance and climate, on average, although the direction and magnitude of the association varies significantly across countries. In three economies – Colombia, Hong Kong (China) and the United Arab Emirates – schools with lower results in science tended to have larger proportions of fully certified teachers, after accounting for differences in student demographics (gender, socio-economic status, immigrant background and language spoken at home). In Colombia and the United Arab Emirates, in fact, only a minority of teachers were "fully certified". In B-S-J-G (China) and the Czech Republic, by contrast, schools with higher scores in science tended to have larger proportions of fully certified teachers – although in B-S-J-G (China) there was limited variation across schools in the share of fully certified teachers, as 98% of all teachers were reported to be fully certified (Figure 2.14 and Table 2.4).

Together, student and teacher demography explained about 66% of the variation in science performance between schools. After accounting for student and teacher demographics, about two-thirds of the schools scored at a level that is within 30 points (above or below) their expected performance (residual between-school standard deviation: 29 score points). Student and teacher demographic characteristics also explained about 25% of the between-school variation in students' reports of disciplinary climate (Tables 2.21 and 2.23).

How teachers' working conditions relate to school success

To understand how the most successful schools support the work of teachers, three variables that relate to important dimensions of their working conditions were added to the analysis: teachers' turnover rate; principals' transformational leadership practices (as reported by teachers); and the number of different in-house professional development activities organised by the school (as reported by the principal).

The teacher turnover rate is measured by the inverse of the average teacher seniority within the school. In schools with relatively stable teaching workforce (number of teachers) and regular flows in and out of the school, the inverse of average seniority (one divided by the average seniority) represents the proportion of teachers who can be expected to leave the school each year, or, equivalently, the proportion of teachers who are joining the school each year. In such a situation, seniority is a good measure of turnover (or the lack of it). In a growing school, however, average seniority tends to be lower than in shrinking schools. The relationship with seniority might therefore be partially confounded by school growth and decline.

School principals' leadership and support is measured through the average index of transformational leadership, a composite measure derived from non-science teachers' agreement ("strongly agree" to "strongly disagree") with the following statements: "The principal tries to

achieve consensus with all staff when defining priorities and goals in school"; "The principal is aware of my needs"; "The principal inspires new ideas for my professional learning"; "The principal treats teaching staff as professionals"; and "The principal ensures our involvement in decision making". Transformational school leaders are able to communicate a mission, encourage development, and build a community with the aim of empowering the teachers to contribute to the school's overall results, thereby indirectly influencing student learning through improvements in staff motivation, commitment and working conditions (Leithwood, Tomlinson and Genge, 1996[38]; Leithwood and Jantzi, 1990[39]; Leithwood, Harris and Hopkins, 2008[40]).

Teachers in the same school had relatively consistent views of the extent to which their principal engages in transformational activities to support their professional growth (Table 2.17). The intra-class correlation is a measure of the extent to which reports varied between schools, rather than only within schools. For this index, the intra-class correlation is about 15% – one of the highest figures for questionnaire-based measures in PISA. It is higher than the intra-class correlation for teachers' reports of job satisfaction, for example, or for students' reports of the disciplinary climate in science lessons.

Finally, teachers' in-house opportunities for professional development are measured by principals' reports about the number of different school-based activities that the school offers: from the more informal ("The teachers in our school co-operate by exchanging ideas or material when teaching specific units or series of lessons") to the more formal ("Our school invites specialists to conduct in-service training for teachers"; "Our school organises in-service workshops which deal with specific issues that our school faces"; "Our school organises in-service workshops for specific groups of teachers [e.g. newly appointed teachers]"). The measure therefore varies between 0 and 4.

Results reveal that, after accounting for teacher and student composition, schools with the best results in science tended to have lower teacher turnover rates (after accounting for differences in teacher experience). This might reflect a negative effect of teacher turnover on teacher effectiveness and student learning; but it might also reflect the greater ability of high-performing schools to retain teachers in their school and in the profession, more generally. The association of teacher turnover with school performance was significant, and negative, in three countries/economies (Australia, Spain and Chinese Taipei), and was positive in one (Brazil) (Figure 2.15).

While teachers' perceptions of the principal as a transformational leader are not related to school performance (though a negative association is observed in Germany), such perceptions are positively related to students' reports about the climate in science lessons, after accounting for differences in student and teacher demographic characteristics. They are also positively related to a lower incidence of bullying in school. The prevalence of bullying was lower in schools where teachers reported that their principals engage in transformational practices (Figure 2.15).

The negative association observed in Germany between transformational leadership and performance might reflect inverse matching, whereby stronger principals are assigned to the schools that struggle the most; or might simply reflect the more urgent need for change and transformation in struggling schools. However, the positive association with the school climate might indicate that principals' leadership can encourage behaviours that are conducive to learning, and indirectly contribute to improve teaching and learning.

School climate has been shown to be associated with valued outcomes of education (Thapa et al., 2013[41]). In particular, the association with disciplinary climate in science lessons was positive and significant in four countries/economies (Brazil, B-S-J-G [China], Italy and the United Arab Emirates) and on average across countries; while the association with the prevalence of bullying is negative and significant in four countries/economies (Australia, Brazil, B-S-J-G [China] and the Dominican Republic), as well as on average across countries (Figure 2.15).

Figure 2.15 ■ **How teachers' working conditions relate to school performance and climate**

After accounting for student and teacher characteristics and for schools' socio-economic profile; results based on multi-level models

Positive relationship
Negative relationship
NS Relationship is not significant
One or more variables are missing; the relationship could not be estimated

	Index of exposure to bullying (based on students' reports)			Index of disciplinary climate in science lessons (based on students' reports)			Student performance in science		
	Index of in-school professional development opportunities	Mean index of principal transformational leadership (teachers' views)	Teacher turnover rate	Index of in-school professional development opportunities	Mean index of principal transformational leadership (teachers' views)	Teacher turnover rate	Index of in-school professional development opportunities	Mean index of principal transformational leadership (teachers' views)	Teacher turnover rate
Average-18	NS		NS	NS		NS	NS	NS	
Australia	NS		NS	NS	NS	NS	NS	NS	
B-S-J-G (China)			NS	NS		NS	NS	NS	NS
Brazil	NS		NS	NS			NS	NS	
Chile	NS	NS	NS	NS	NS	NS	NS	NS	NS
Colombia	NS	NS	NS	NS	NS	NS	NS	NS	NS
Czech Republic	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dominican Republic			NS	NS	NS	NS	NS	NS	NS
Germany	NS	NS		NS	NS	NS	NS		NS
Hong Kong (China)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Italy				NS		NS	NS	NS	NS
Korea	NS	NS	NS		NS	NS	NS	NS	NS
Macao (China)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Peru	NS	NS	NS	NS	NS	NS	NS	NS	NS
Portugal	NS	NS	NS	NS	NS	NS	NS	NS	NS
Spain	NS	NS		NS	NS	NS	NS	NS	
Chinese Taipei	NS	NS	NS	NS	NS	NS	NS	NS	
United Arab Emirates	NS	NS	NS	NS		NS	NS	NS	NS
United States	NS	NS	NS	NS	NS	NS	NS	NS	NS
Massachusetts				NS		NS		NS	NS
North Carolina				NS	NS	NS	NS	NS	NS

Note: Results based on multi-level models, including controls for students' gender, socio-economic status, immigrant background and language spoken at home, as well as for schools' average socio-economic profile, share of female students, average years of experience among teachers and share of fully certified teachers. Three distinct models were estimated for performance in science, disciplinary climate and bullying. Only countries/economies that distributed the optional teacher questionnaire are included in the analysis. Results for Malaysia are not reported, as the sample may not be representative.

The Average-18 does not include Massachusetts and North Carolina.

Countries and economies are listed in alphabetical order.

Source: OECD PISA 2015 Database, Tables 2.25, 2.26 and 2.27.

StatLink http://dx.doi.org/10.1787/888933740459

The index of in-house professional development opportunities was not significantly associated with performance or school climate, on average across countries, after accounting for student and teacher composition and for teacher turnover and principal leadership. There was, nevertheless, a positive and significant association with science performance in public schools in Massachusetts (United States), and with the classroom climate reported by students in Korea – a country in which teacher turnover and principals' transformational leadership were not significantly related to school performance or school climate (Figure 2.15).

Summing up, Figure 2.14 shows that teacher experience is positively related to school performance and student behaviour, while Figure 2.15 shows that teacher turnover is negatively related to performance, after accounting for differences in student and teacher demographic characteristics across schools. Student behaviour, as reflected in the index of disciplinary climate in science lessons and the index of exposure to bullying, is, in turn, more positive in schools whose principal is perceived as a transformational leader who supports and empower teachers.

While the analysis only reveals correlational associations, recent studies, based on rich longitudinal data linking teachers and students over multiple years and grades, suggest that high turnover rates do indeed adversely affect the quality of instruction (Ronfeldt, Loeb and Wyckoff, 2013[42]; Hanushek, Rivkin and Schiman, 2016[37]). Similar, though smaller, effects have been found for within-school churning rates, i.e. the assignment of teachers to a new grade within the same school (Atteberry, Loeb and Wyckoff, 2016[43]). Teacher turnover can harm student learning because schools with high turnover lose institutional memory with departing teachers. Teacher turnover leads to disruption of working norms; and departing teachers are typically more effective than new hires. While, in theory, turnover could also help organisations by infusing new ideas and creating better job matches (e.g. by ensuring that the best teachers are assigned where they can have the greatest impact, and that the worst teachers leave the profession), most studies find that these positive effects are more than offset by the negative effects of teacher turnover on student learning.

A study based on New York City schools, for example, shows that grades with a greater share of teachers new to the school in a particular year saw less growth in achievement; and similarly, within a particular school and grade, the years with more teachers who were new to the school showed less achievement growth (Ronfeldt, Loeb and Wyckoff, 2013[42]). This study further found that all students suffer from high turnover rates, not only those who were assigned to new-to-the-school teachers. This lends support to the view that turnover imposes a cost on the organisation as a whole, and exerts its effect not only through the average quality of teachers.

Another study, based on a large, urban district in Texas (United States), shows that, in general, teachers who quit the school are usually less effective than those who stay; but the resulting need to fill the vacancy leads to the hiring of teachers who are less experienced in the particular grade or in teaching more generally than the departing teachers. As a result, high-turnover schools again show less growth in student achievement (Hanushek, Rivkin and Schiman, 2016[37]).

Notes

1. The seven jurisdictions analysed are: Finland, Singapore, the provinces of New South Wales (Australia) and Victoria (Australia), the states of Alberta (Canada) and Ontario (Canada), and the municipality of Shanghai (China).

2. In several countries where 15-year-olds are found in both lower-secondary and upper-secondary schools, and data on both types of schools are therefore available, principals in upper secondary schools report greater levels of responsibilities for teacher hiring, firing, or compensation than lower-secondary schools (Tables 2.9 and 2.10). Among high-performing countries, this is observed in Germany, Korea, Slovenia, Switzerland and Chinese Taipei.

3. Here, and in the remainder of this chapter, "r" refers to the Pearson correlation coefficient, a measure of the linear association between two variables, which varies between -1 (indicating a perfect inverse relationship between the two variables) and 1 (indicating a perfect linear relationship between two variables). Values close to 0 indicate weak linear relationships.

4. In Korea, only 88% of students were in schools that organise in-service workshops for specific groups of teachers, but 96% of students were in schools that organise workshops that deal with specific issues faced by the school.

5. A change in the translation might explain the strong variation of fully certified teachers across PISA cycles in Colombia. In PISA 2006, the school questionnaire in Colombia asked about "Profesores completamente certificados por una autoridad competente"; in PISA 2012, it asked about "Profesores *normalistas* completamente certificados por una autoridad competente" (emphasis added); in PISA 2015, it asked about "Profesores *totalmente* certificados por *el Ministerio de Educación Nacional*" (emphasis added).

6. Changes in the mean science performance of PISA-participating countries and economies, from 2006 through 2015, can be found in Table 1.2.4a in volume I of *PISA 2015 Results* (OECD, 2016[46]).

7. Two distinct populations of teachers were identified in each school: science and non-science teachers. The sampling rates may differ between the two populations (OECD, 2017[45]). The two populations were given distinct, but partially overlapping questionnaires. Questions on experience and seniority were asked of all teachers; in contrast, questions about the school principal's transformational leadership practices were only asked of non-science teachers. In analyses included in this chapter, teachers' answers are aggregated to the school level through simple, unweighted means.

8. In Malaysia, due to low response rates, the sample of responding schools does not fully cover the target population defined by all schools attended by 15-year-olds enrolled in grade 7 and above in the country. Results for Malaysia must therefore be interpreted with caution (OECD, 2017, p. 271[45]).

9. Full details about the scaling model used for the index of disciplinary climate can be found in the PISA 2015 technical report (OECD, 2017[45]).

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