TALIS

Mending the Education Divide

GETTING STRONG TEACHERS TO THE SCHOOLS THAT NEED THEM MOST

OECD

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BETTER POLICIES FOR BETTER LIVES

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Foreword

Achieving greater equity in education is a central goal of education systems worldwide. Students' individual circumstances – over which they have no control – such as their parents' occupations, the language they speak at home or their place of birth, continue to be strong predictors of achievement in school. Analyses based on PISA data have repeatedly shown that while many disadvantaged students succeed at school, students from affluent families tend to outperform their disadvantaged peers in all subjects.

The COVID-19 pandemic and the subsequent disruption in schooling exposed the inherent inequities of education systems. Learning losses during school closures were most severe among less advantaged students, students living in rural areas, and students with learning difficulties. The pandemic showed how students from marginalised backgrounds can, for various reasons, fall behind: they tend to have more limited access to digital learning resources at home; often, they have less support from their parents; and they can be simply less motivated to learn on their own. Even less widely recognised is the fact that students taught by teachers who weathered the storm caused by school closures have had very different learning experiences to students whose teachers struggled.

Among all the things that schools can do to raise students' cognitive and social-emotional skills, teacher quality is by far the most important. Research shows that children taught by different teachers often experience very different educational outcomes. This suggests that the distribution of good teachers is crucial to achieving greater equity in education. And that a truly robust recovery from the pandemic requires good teachers to be allocated to the students who have suffered the most.

In most education systems, however, socio-economic disadvantage tends to be compensated for in terms of quantity rather than quality because quality is usually much harder to measure. Typically, investments to help disadvantaged students target visible and measurable indicators, such as smaller classes and/or lower student-teacher ratio. Unfortunately, more resources does not always mean better resources.

This report focuses on teacher quality. It shows how teachers with certain characteristics and practices tend to concentrate in certain types of schools. It also shows how students with different socio-economic backgrounds differ in their access to good teachers. Compared to previous OECD reports, the current report expands on the range of teacher and school characteristics and practices analysed through the lens of equity.

This report relies on the OECD Teaching and Learning International Survey (TALIS). Based on the best available research evidence to elicit information on teacher characteristics and practices associated with effective teaching and higher student performance. TALIS is the largest international and periodic survey on teachers and school leaders about their working conditions and learning environments.

What we find is a mixed bag. Systematic sorting is evident along some dimensions that are related to effective teaching, such as teacher experience and time spent by teachers on actual teaching. More often than not, experienced teachers and those who maximise instruction time are over-represented in socio-economically advantaged schools. This matters since the reading proficiency of disadvantaged students tends to be higher in education systems where experienced teachers are more evenly distributed across schools. However, on a more positive note, the sorting of teachers along other characteristics and practices of effective teaching, such as the content of their initial education, self-efficacy, cognitive activation and clarity of instruction, is less prevalent.

The report places a special focus on students' access to digital learning in school. The pandemic has made the use of information and communication technology (ICT) much more pervasive and this is only the beginning of education's digital transformation. Technology can improve teaching and learning, help students acquire a broader range of skills, and improve equity. However, when ICT infrastructure is inadequate or teachers are ill at ease with digital tools, technology can lead to an increase in inequalities. The pandemic has exposed the challenge education systems face in addressing inequalities in students' digital learning. We believe that this report, which draws on TALIS 2018 data collected before the pandemic, reveals valuable insights into the extent and nature of digital divides.

The report explores the types of schools (and students) that are more likely to benefit from the resources needed for effective digital learning. The results show that the provision of quality instruction in socio-economically disadvantaged and public schools is more likely to be hindered by insufficient Internet access and inadequate digital technology. In addition, teachers with high self-efficacy in ICT use tend to be over-represented in private schools. Here as well, we find a link between teacher allocation and student outcomes. Notably, opportunities to learn digital literacy skills are more equitable when the distribution of teachers with high digital self-efficacy is more even.

In sum, the findings of this report suggest that effective teachers do not necessarily work in the schools that need them most and that this can give rise to socio-economic inequalities in student performance. This calls for policies aimed at ensuring a more equitable allocation of teachers. The match between teachers and schools can be improved in most education systems. However, this is easier said than done. The right policy mix is required, one that is sensitive to the specific context of each country's education system. Teacher allocation touches upon various issues, from school autonomy in staffing to teacher preferences and incentives. The criteria and processes guiding the recruitment of teachers and funding allocation for schools are, of course, central.

With a more equitable allocation of teachers comes the promise of more educational opportunities for the most disadvantaged students. The potential returns to education are huge. Greater equity can mean a more efficient use of resources; the growth of knowledge and skills among all students, not just the few; and a step further toward social justice. These are all essential building blocks for our social and economic development, and cohesion. It is worth all the efforts required.

Andreas Schleicher

Director for Education and Skills

Special Advisor on Education Policy to the OECD Secretary-General

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The results referred to in this volume are provided in Annex C.

Country coverage

The publication features results on teachers and school principals working in schools providing lower secondary education (ISCED level 2) in 48 countries and territories, as well as in 2 sub-national entities (the Flemish Community of Belgium and the French Community of Belgium) that opted for their data to be adjudicated.

In tables, countries and territories are ranked in alphabetical order. There are two exceptions to this rule:

- The Flemish Community of Belgium and the French Community of Belgium are indented and italicised, under Belgium.
- Countries that have not met TALIS standard participation rates are placed at the bottom of the tables.

There are six sub-national entities participating in TALIS 2018. They are referred to in the following manner:

- The province of Alberta, in Canada, is referred to as Alberta (Canada).
- The Flemish Community of Belgium is referred to as Flemish Comm. (Belgium) in tables and figures.
- The French Community of Belgium is referred to as French Comm. (Belgium) in tables and figures.
- Ciudad Autónoma de Buenos Aires is referred to as CABA (Argentina).
- The nation of England is referred to as England (United Kingdom), or England (UK) in tables and figures.
- The municipality of Shanghai, in China, is referred to as Shanghai (China).

The People's Republic of China is hereafter referenced as "China".

Chinese Taipei and Cyprus did not participate directly in TALIS 2018: their data collection and processing were managed exclusively by the international research consortium. Their data are reported in the result tables listed in Annex C.

Two notes are added to the information on Cyprus:

- **Note by Turkey:** The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".
- **Note by all the European Union Member States of the OECD and the European Union:** The Republic of Cyprus is recognised by all members of the United Nations with the exception of

Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

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.

Classification of levels of education

The classification of levels of education is based on the International Standard Classification of Education (ISCED). ISCED is an instrument for compiling statistics on education internationally. ISCED-97 was recently revised, and the new International Standard Classification of Education (ISCED-2011) was formally adopted in November 2011 and is now the basis of the levels presented in this publication. It distinguishes between nine levels of education:

- early childhood education (ISCED level 0)
- primary education (ISCED level 1)
- lower secondary education (ISCED level 2)
- upper secondary education (ISCED level 3)
- post-secondary non-tertiary level of education (ISCED level 4)
- short-cycle tertiary education (ISCED level 5)
- bachelor's or equivalent level (ISCED level 6)
- master's or equivalent level (ISCED level 7)
- doctoral or equivalent level (ISCED level 8).

This report focuses on lower secondary education (ISCED level 2).

Reporting teacher data

The report uses "teachers" as shorthand for the TALIS target population of lower secondary teachers. TALIS covers teachers who, as part of their regular duties in a target school, provide instruction in programmes at the ISCED 2 level (lower secondary education).

Reporting principal data

The report uses "principals" and "school leaders" as equivalent shorthand for the TALIS target population of lower secondary principals. School principals provided information on their schools' characteristics and their own work and working conditions by completing a principal questionnaire. Where responses from school principals are presented in this publication, they are weighted by the school weights.

International averages

The OECD and TALIS averages correspond to the arithmetic mean of the respective country estimates. They are calculated for most indicators based on the main survey data (ISCED level 2) presented in this report. The European Union average, called "EU total", takes the European Union member states as a single entity, to which each country contributes in proportion of the estimated size of the target population. It can be used to assess how a country compares with the European Union as a whole.

The system-level estimates of the Flemish Community of Belgium and the French Community of Belgium are not included in the international averages, as these sub-national entities already contribute to the international averages through the means of Belgium as a whole.

The system-level estimates of countries that have not met the standards for TALIS participation rates are excluded from the international averages. This is the case for the estimates based on the responses of lower secondary principals in Australia.

In the case of some countries, data may not be available for specific indicators, or specific categories may not apply. Readers should, therefore, keep in mind that the terms "OECD average", "TALIS average" and "EU total" refer to the countries included in the respective averages. Each of these averages may not necessarily be consistent across all columns of a table.

The number of countries or territories included in an international average is indicated next to that average:

- **OECD average-31:** arithmetic average based on ISCED 2 teacher data across 31 OECD countries and territories with adjudicated data. The report refers to the average teacher "across the OECD" as equivalent shorthand for the average teacher "across the 31 OECD countries and territories participating in TALIS".
- **OECD average-30:** arithmetic average based on ISCED 2 principal data across 30 OECD countries and territories with adjudicated data. The report refers to the average school or principal "across the OECD" as equivalent shorthand for the average school or principal "across the 30 OECD countries and territories participating in TALIS".
- **TALIS average-48:** arithmetic average based on ISCED 2 teacher data across 48 TALIS 2018 countries and territories with adjudicated data.
- **TALIS average-47:** arithmetic average based on ISCED 2 principal data across 47 TALIS 2018 countries and territories with adjudicated data.
- **EU total-23:** weighted average based on ISCED 2 teacher or principal data across all EU member states that participate in TALIS with adjudicated data.

The list of countries and territories included in each international average is provided in Annex B.

Data underlying the figures

Five symbols are used to denote non-reported estimates:

- a: The question was not administered in the country because it was optional or it is part of a questionnaire from a TALIS cycle the country has not participated in. Therefore, data are missing.
- c: There are too few or no observations to provide reliable estimates and/or to ensure the confidentiality of respondents (i.e. there are fewer than 10 schools/principals and/or 30 teachers with valid data; and/or the item non-response rate [i.e. ratio of missing or invalid responses to the number of participants for whom the question was applicable] is above 50%).
- m: Data were collected but subsequently removed for technical reasons (e.g. erroneous translation) as part of the data checking process.
- n: Data is missing due to computational process (e.g. regression coefficients are missing if there is at least one variable without valid data included in a regression model; or else in the case of non-convergence of the maximum likelihood function).
- w: Data were withdrawn or were not collected at the request of the country concerned.

TALIS results are based exclusively on self-reports from teachers and school leaders and, therefore, represent their opinions, perceptions, beliefs and accounts of their activities. No data imputation from administrative data or other studies is conducted and, as with any self-reported data, this information is subjective and may, therefore, differ from data collected through other means (e.g. administrative data or video observations). The same is true of school leaders' reports about school characteristics and practices, which may differ from descriptions provided by administrative data at a national or local government level.

Rounding figures

Because of rounding, some figures in tables may not add up exactly to the totals. Totals, differences and averages are always calculated on the basis of exact numbers and are rounded only after calculation.

All standard errors in this publication have been rounded to one, two or three decimal places. Where the value 0.0, 0.00 or 0.000 is shown, this does not imply that the standard error is zero, but that it is smaller than 0.05, 0.005 or 0.0005, respectively.

Focusing on statistically significant differences

This volume only comments on statistically significant differences or changes. These are denoted in darker colours in figures and in bold font in tables. See Annex B for further information.

Abbreviations

ISCED	International Standard Classification of Education
% dif.	percentage-point difference
Coef.	regression coefficient
ICC	intra-class correlation
ICT	information and communication technology
S.D.	standard deviation
S.E.	standard error

Further technical documentation

For further information on TALIS documentation, instruments and methodology, see the *TALIS 2018 Technical Report* (OECD, 2019[1]) and *TALIS 2018 and TALIS Starting Strong 2018 User Guide* (OECD, 2019[2]).

This report uses the OECD StatLinks service. All tables and charts are assigned a URL leading to a corresponding Excel[TM] workbook containing the underlying data. These URLs are stable and will remain unchanged over time. In addition, readers of the e-books will be able to click directly on these links and the workbook will open in a separate window if their Internet browser is open and running.

References

OECD (2019), *TALIS 2018 and TALIS Starting Strong 2018 User Guide*, OECD, Paris, http://www.oecd.org/education/talis/TALIS_2018-TALIS_Starting_Strong_2018_User_Guide.pdf. [2]

OECD (2019), *TALIS 2018 Technical Report*, OECD, Paris, http://www.oecd.org/education/talis/TALIS_2018_Technical_Report.pdf. [1]

Executive summary

Remote schooling during the early months of the COVID-19 pandemic salvaged education for many students. But online classes did not work for everyone. While differences in access to the Internet and digital tools have been shrinking across the OECD, PISA 2018 shows a persistent gap between disadvantaged students with lower digital skill levels and advantaged students who readily use the Internet. This contributed to greater learning losses during the pandemic for vulnerable students. As society and schools move back to more normal functioning, we will need our best teachers and digital resources to help students find their footing again. But what constitutes "good" or effective teaching? And are good teachers working in the schools that really need them?

Chapter 1 lays bare the problematic at hand: how much access do disadvantaged students have to the effective teaching, and digital equipment and infrastructure that can help them overcome difficulties they have no power over and yet, which may be holding them back?

Chapter 1 also identifies how teachers with certain characteristics like experience and self-efficacy, and practices like cognitive activation are distributed through the different kinds of schools in countries' education systems: schools with student populations that are socio-economically advantaged or disadvantaged; public or private; rural or urban. Dissimilarity indices show the degree of clustering there is.

But what exactly constitutes good teachers and good teaching? Chapter 2 lays out good teacher characteristics and practices. TALIS 2018 survey data reveal marked unevennesses in distribution; for example, of experienced teachers who are clustered in socio-economically advantaged schools in nearly one-third of countries that participated in TALIS. This has consequences, especially for the reading proficiency of disadvantaged students: it tends to be higher in education systems in which experienced teachers are more evenly distributed across schools.

Another Chapter 2 highlight is that teachers who make the most of actual teaching time during class tend to teach in socio-economically advantaged schools, again, in more than one-third of countries that participated in TALIS. That said, it is not necessarily the case that teachers who know how to optimise actual teaching time are distributed more heavily in advantaged schools. It is also possible that teachers in schools whose students are, for the most part, less well-off are unable to maximise their teaching time because classes are frequently disrupted by disciplinary problems.

Chapter 3 turns to digital matters and equity. It looks at Internet connectivity and digital equipment in schools, and teachers' digital skills, training, self-efficacy and use in their teaching. Unsurprisingly, schools that have such inadequate digital resourcing that it hinders good teaching fall more often in the public sphere than private, and in rural areas more than cities. They also have a mostly disadvantaged student population. But simple access to information and communication technology (ICT) on its own is not enough for students to develop digital skills such as accurately detecting biased information on the Internet. Students need guidance from teachers who are trained in and at ease with the technology, and use it regularly. TALIS 2018 data show that digitally savvy teachers are more likely to teach in private schools in almost a quarter of countries and economies participating in TALIS. But, Chapter 3 cautions, upgrading schools' ICT infrastructure and redistributing teachers isn't enough to give students a fair chance at digital learning. What does help? Collaboration between teachers. TALIS data show that when teachers work on projects together, their use of digital technologies in the classroom goes up on average across OECD countries.

What is the link between inequality of access to strong teachers and the difference in learning between advantaged and disadvantaged students? Chapter 4 delves into this, noting that countries and economies with uneven distributions of experienced teachers also obtained lower average scores in the PISA 2018 reading assessment. A similar observation is made of education systems in which teachers with thorough training as well as teachers who are skilled at optimising class time are unevenly allocated, and in all three cases, especially for disadvantaged students. In terms of students' digital literacy, it is access to teachers with high digital self-efficacy that is key. Disadvantaged students have opportunities to learn digital skills that are better or just as good as advantaged students when teachers who are confident about using ICT are distributed more evenly.

Chapter 4 also looks at potential ways education systems can get more good teachers to teach in the disadvantaged schools that need them most. School autonomy shows some promise here, though there are often other factors at work as well. Systems that give schools more leeway in hiring and firing teachers and setting salaries seem to have a more equal distribution of their best teachers. Factors, like experience, which carry great weight in teacher distribution in centralised education systems are of less importance in more localised ones, rendering teacher experience a strength that is more on par with a wider range of criteria. Schools often do a better job than education systems of identifying teacher strengths that, unlike years of experience, are difficult to pinpoint. In addition, the more autonomy school leaders have in adapting teachers' pay to reflect the difficulty of tasks, the better schools are able to attract the strongest teachers to the most challenging classrooms.

Still, there are caveats to granting schools more autonomy over staffing decisions. Increased autonomy requires more stringent accountability measures, and mechanisms to help disadvantaged schools compete against advantaged ones in attracting talented teachers. Progressive school funding models, such as those in Sweden, allow disadvantaged schools to pay higher salaries. Often, it is not financial incentives that attract better teachers to disadvantaged schools but fast-tracked teacher career progression: this is a feature of systemic policies, such as Shanghai's (China). Lastly, controlled-choice models, such as those in the Flemish Community of Belgium, are another example of ways to achieve a more equitable distribution of effective teachers: granting parents the freedom to choose the school for their children while letting schools be involved in the recruitment of teachers incentivises schools to seek out specific teacher characteristics to meet school needs. In this model, schools' freedom in recruiting staff is accompanied by additional accountability measures and funding based on need.

1 Overview: What TALIS insights about teacher allocation imply for policy

This report uses 2018 Teaching and Learning International Survey (TALIS) data to examine how teachers are distributed across different schools. By doing so, it provides important insights on the extent to which different students have access to effective teachers and good learning environments. This chapter briefly describes the analytical approach employed in the report, and then provides an overview of the report's main findings. The chapter ends with some recommendations for education policy that could lead to a more equitable allocation of teachers, and potentially, to a decrease in socio-economic inequalities in student outcomes.

Introduction

Equity in teaching and learning has been a central goal of education systems worldwide. One of the 17 Sustainable Development Goals (SDGs) adopted by United Nations member states as part of the 2030 Agenda for Sustainable Development is: ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all (United Nations, 2015[1]). Enabling all students to have access to the best education opportunities is a way of using resources effectively, and improving education and social outcomes in general (OECD, 2019, p. 42[2]). The COVID-19 pandemic and subsequent disruption in schooling has drawn further attention to the issue of inequities in education. Learning losses during school closures have been most severe among marginalised students (OECD, 2021[3]).

Succeeding in today's fast-changing world requires a wide range of skills and the capacity to continuously learn new ones. Poor or inadequate skills limit access to better-paying and more rewarding jobs and, more generally, to better living and health conditions, and greater social and political participation (Hanushek et al., 2015[4]; OECD, 2016[5]). Yet, in most education systems, students' individual circumstances over which they have no control, such as their parents' occupations, the language they speak at home or their place of birth, tend to be strong predictors of achievement in school (OECD, 2019, p. 42[2]). Analyses based on Programme for International Student Assessment (PISA) data show consistently that while many socio-economically disadvantaged students succeed at school, students from socio-economically advantaged family backgrounds tend to outperform their disadvantaged peers in all subjects (OECD, 2019[2]). Equity does not mean that all students must obtain equal outcomes; rather, it means that all students should be provided with the same opportunities so that differences in outcomes are not driven by factors that are outside of students' control (OECD, 2018[6]). To ensure such equality of opportunities it is often necessary to explicitly devote more resources to students who start at a disadvantage in order to level the playing field.

Previous TALIS reports have investigated to what extent disadvantaged children have equal opportunities in terms of access to effective teachers, effective curricula and effective teaching practices, and how schools can make up for students' disadvantaged backgrounds. The TALIS 2013 report explored how equitably experienced and trained teachers were distributed across different types of schools (OECD, 2014[7]). The first volume of the report on TALIS 2018 showed that teachers tend to work in more challenging schools (i.e. schools with a higher concentration of students from socio-economically disadvantaged homes and students with an immigrant background) when they are in the early years of their career (OECD, 2019[8]). It also showed that classroom time spent on actual teaching and learning is significantly lower in schools with less experienced teachers and with high concentrations of students from socio-economically disadvantaged homes, students with special education needs and immigrant students. The second volume of the report on TALIS 2018 indicated that teachers working in schools with a high concentration of socio-economically disadvantaged students are more likely to report a desire to change schools than those working in schools with lower concentrations of these students (OECD, 2020[9]). While past TALIS reports provided insights into the distribution of resources across schools, they covered a limited subset of teacher characteristics and practices.

Past analyses of PISA 2015 data also looked at equity by examining how teacher resources vary across different school profiles. These analyses showed that in 2015 a majority of countries and territories that participated in PISA compensated disadvantaged schools by providing them with more teacher resources – through smaller classes and/or lower student-teacher ratios. However, in more than a third of countries and territories, teachers in the most disadvantaged schools were less qualified or less experienced than those in the most advantaged schools (OECD, 2018[10]). Thus, in disadvantaged schools, teacher quality tends to be compensated for with quantity in terms of teaching resources.

This is important. Among all the things that schools can do to raise students' cognitive and social-emotional skills, teacher quality is by far the most effective (Hattie, 2009[11]; Rice, 2003[12]; Seidel and Shavelson, 2007[13]). A large body of research literature shows that teachers have a large impact on students' outcomes (Aaronson, Barrow and Sander, 2007[14]; Jackson, Rockoff and Staiger, 2014[15]; Rivkin, Hanushek and Kain, 2005[16]). Moreover, the impact of teachers is long-lasting (Chetty et al., 2011[17]). Teacher impact is not limited to academic achievement or other cognitive outcomes either as there is now robust evidence that teachers can also raise students' social and emotional skills (Blazar and Kraft, 2017[18]; Jackson, 2018[19]).

Identifying what precisely makes teachers effective is much harder and still an active strand of investigation. Recent literature has stressed the importance of teachers-students match in terms of teacher characteristics and teaching practices, and students' characteristics and learning profiles (Dee, 2005[20]; Fairlie, Hoffmann and Oreopoulos, 2014[21]; Gershenson et al., 2018[22]; Gershenson, Holt and Papageorge, 2016[23]; Lim and Meer, 2017[24]). In other words, some teachers are more effective with some students than others, and some teaching practices work better with some students than with others.

That said, there are certain teacher characteristics and teaching practices more than others that, on average, are consistently associated with better student outcomes. These include teachers' experience; self-efficacy; ability to maximise instruction time; clarity of instruction; use of cognitive activation; and the content of their initial teaching education. Other factors that are important for students' outcomes do not depend on teachers but on principals and their ability to create effective learning communities. In environments where school leaders facilitate and complement teachers' work, the overall results are often greater than what the sum of the individual components would deliver elsewhere. Concrete actions that principals can take to create effective learning environments include managing the curriculum; attending to teachers' professional development needs; and creating a culture of collaboration. TALIS measures principals' capacity to be instructional leaders and the presence of teachers' mentoring systems in the school.

This report provides further insights into the allocation of effective teachers and students' unequal access to effective teaching practices and learning environments. The identification of effective teachers and teaching practices relies on proxy measures collected in TALIS and described in the previous paragraph. In doing so, it focuses on teacher and school resources in terms of quality rather than quantity. It also expands the range of teacher and school characteristics and practices analysed from an equity point of view compared to previous OECD reports. The report uses the terms allocation, distribution and sorting interchangeably. This is important to note as these terms can have slightly different meanings and evoke slightly different concepts. Teacher allocation, for instance, can be interpreted as the result of top-down choices over which teachers have little say; sorting, on the other hand, is often associated with the results of individual choices; distribution, finally, is probably the most neutral and descriptive term. As TALIS data do not allow disentanglement of the different mechanisms that lead to the observed distribution of teachers across schools in different countries, these terms are used interchangeably in this report and should be interpreted as having a neutral connotation.

Building on the literature that identifies characteristics and practices of teaching that boost students' achievement, this report shows how effective teachers and teaching practices tend to concentrate in certain kinds of schools. A special focus is devoted to teachers' ability to integrate information and communication technology (ICT) in their teaching and the actual use of ICT for teaching. The use of digital technology for teaching and learning can help students acquire digital skills, social-emotional skills and more standard cognitive skills such as numeracy and literacy. While teachers' reliance on ICT has increased considerably in the wake of the COVID-19 pandemic, available evidence also shows that learning losses have been the most severe among marginalised students since the health crises (OECD, 2021[3]). Looking at students' access to good quality digital infrastructure, equipment and teachers who were at ease with ICT in their teaching previous to the pandemic may fill in some blanks about these learning losses we see now. The report also investigates the extent to which students attending different types of schools – by concentration of students from socio-economically disadvantaged homes (i.e. disadvantaged versus advantaged schools),[1] school location (i.e. city schools versus rural schools) and school governance (i.e. privately managed versus publicly managed schools)[2] – have different access to good teachers and teaching practices as well as effective learning environments.

By investigating how certain teachers and teaching practices are allocated across schools, and the extent to which all students have fair access to good teachers, teaching practices and learning environments, this report complements a recent PISA report that showed how students sorted by ability and socio-economic background across schools (OECD, 2019[25]). Concentration of good students in a restricted number of schools can increase inequalities to the extent that students benefit from being exposed to more able peers. In the same vein, the concentration of effective teachers in a limited number of schools can increase inequalities as only a minority of students will have access to effective teachers. Inequalities can also increase if effective teachers are more likely to teach in schools where students that are already advantaged are concentrated.

The same PISA report also explored whether school-choice policies can have consequences on the sorting of students, and whether they are associated with the effectiveness and equity of education systems (OECD, 2019[25]). The present report points out different aspects of education systems that can influence how teachers are allocated across schools. These include the degree of autonomy schools have in hiring, firing, and rewarding teachers, and the degree of competition they face in recruiting students. It also discusses the consequences that inequitable teacher allocation can have on average student achievement and socio-economic inequalities in student performance.

In sum, this report aims to address the following questions:

- Chapter 2: Do students have equitable access to effective teachers?
- Chapter 3: Do students have equitable access to digital learning in school?
- Chapter 4: How is the sorting of effective teachers and teaching practices related to inequalities in student outcomes? Are there system-level policies, such as school competition and school autonomy in hiring and dismissing teachers, and determining teachers' salaries that are associated with more even and equitable sorting of teachers across schools?

Equality or equity?

This report analyses students' access to effective teachers and teaching practices from two different angles:

- **Equality:** By investigating the extent to which teachers with certain traits are equally allocated across schools, the chapter addresses issues related to equality. This analysis focuses only on the characteristics of teachers. It disregards student characteristics as well as the fact that students themselves sort across schools based on their personal characteristics (OECD, 2019[25]). An equal distribution of good teachers results in students being evenly exposed to effective teaching. A more diverse teachers' body also helps teachers learn from their peers and improve their own practices when there is sufficient collaboration among teachers working in the same schools. This enriches peer learning through the exchange of ideas and interactions (Goddard, Goddard and Tschannen-Moran, 2007[26]; Reeves, Pun and Chung, 2017[27]). The analysis related to equality is based on the dissimilarity index (see Box 2.1 for more detail). This captures the extent to which the distribution of teachers departs from what would be observed if teachers were allocated across schools in a perfectly random way. A random allocation of teachers would ensure that, on average, all students irrespective of their personal or socio-economic profile, are taught by teachers who, altogether in a school, reflect the characteristics of the overall teacher population of the education system rather than a subset of that population.
- **Equity (or fairness):** Providing equal resources to all students irrespective of their characteristics, by randomly assigning teachers to schools might not, however, help in addressing concerns related to equity. This report also examines the types of schools in which teacher and school resources

tend to concentrate, thereby addressing *equity* issues. In this context, the notion of *equity* (which could, in this context, be considered as a synonym of *fairness)* refers to providing the opportunity for all students to realise their potential by removing obstacles they may face because of factors individual students have no control over. These include students' socio-economic background, ethnic origin, special education needs, gender and giftedness (Cerna et al., 2021[28]; OECD, 2017[29]). Equitable school systems are able to weaken the link between students' individual circumstances and their education outcomes (OECD, 2019, p. 42[2]).

These two angles, *equality* and *equity*, are complementary. Although the analysis on equality in students' access to effective teachers and teaching practices disregards the characteristics of the students, it can still identify teacher characteristics and practices along which teachers tend to sort across schools. The dissimilarity index highlights overall imbalances in teacher allocation. On the other hand, analysis focusing on equity draws a more detailed picture of teacher allocation. Notably, it examines how teachers with certain characteristics and practices are distributed across different types of schools. The distinction between these two concepts is relevant only when there is a segregation of students, when similar students cluster in the same schools. If students were randomly distributed across schools, an equal allocation of teachers across schools would also be equitable. Throughout this report, the distribution of students will be taken as a given; an in-depth analysis of students' segregation is contained in (OECD, 2019[25]).

To what extent can TALIS identify "effective" teachers?

Research shows that children taught by different teachers often experience very different educational outcomes. Teacher quality is the most important school-related predictor of student achievement (Hattie, 2009[11]; Rice, 2003[12]; Seidel and Shavelson, 2007[13]). Nevertheless, evidence is less conclusive about the specific characteristics and actions of teachers that boost student achievement, and consequently about what exactly makes an "effective" (or "strong", "good, "quality") teacher. This is partly due to the fact that teaching is a complex and multidimensional activity that is also influenced by contextual factors such as the "match" between the teacher and the school (Jackson, 2013[30]) and the "match" between teachers' and students' socio-demographic characteristics (Dee, 2005[20]; Fairlie, Hoffmann and Oreopoulos, 2014[21]; Gershenson et al., 2018[22]; Gershenson, Holt and Papageorge, 2016[23]; Lim and Meer, 2017[24]). Different teaching styles and practices can be especially beneficial for some students but less so for others. It is, therefore, difficult to pinpoint teaching practices that are "superior" to others. For instance, there is evidence that cognitive activation strategies may be more beneficial for socio-economically advantaged students (Caro, Lenkeit and Kyriakides, 2016[31]; Le Donné, Fraser and Bousquet, 2016[32]) and teacher-centred instruction for disadvantaged, at-risk students (Butler, 2020[33]).

A consensus is slowly growing on what constitutes effective teaching and what makes an "effective" teacher (OECD, 2020[34]). Good teaching requires a well-managed classroom in which disruptions are minimised and learning time is maximised. Effective teachers must be able to communicate in a clear and comprehensive way; they should help students gain a deep understanding of the subject by requiring them to evaluate, integrate and apply knowledge to solve problems; they should be able to provide effective support to students, listening to their needs, respecting their ideas, and encouraging them (Brussino, 2021[35]); they should provide constructive feedback through both formative and summative assessments. Effective teachers should also, of course, be competent professionals: they should possess and continue to develop appropriate content and pedagogical knowledge as well as affective and motivational competencies, and this knowledge should inform their teaching practices (Guerriero, 2017[36]).

TALIS cannot measure teacher effectiveness directly as it is not an assessment of teachers but a tool to help teachers' and school leaders' voices to be heard. TALIS enables teachers and principals to provide input into educational policy analysis and development in key areas. TALIS results are based exclusively on self-reports from teachers and school leaders. They, therefore, represent their opinions, perceptions, beliefs and accounts of their activities. Yet, a large and growing body of literature focusing on identifying teacher attributes and teaching practices that improve students' cognitive and socio-emotional development inform TALIS' conceptual framework (Ainley and Carstens, 2018[37]) and the questionnaires administered as part of the survey. This report draws on data from TALIS 2018 and examines how teachers' characteristics and practices that research has shown to be robustly correlated with students' achievement are distributed across schools.

Given that this report aims at informing policies about the allocation of teachers in order to achieve more equitable outcomes for students, the distinction between teacher characteristics and teaching practices is particularly relevant. Teacher characteristics such as years of teaching experience and content of formal education are considered to be portable assets that teachers possess irrespective of the schools they work at. In contrast, teaching practices are assumed to be an explicit choice made by teachers depending on the context in which the instruction takes place. Hence, teachers may adopt different practices in a different school, or even with different students in the same school.

This report looks at equity from the viewpoint of students. The analyses gauge the extent to which students have fair access to effective teachers and digital learning at school. However, TALIS contains little information about the characteristics of each student that surveyed teachers teach. Students' characteristics are available only at the school level as reported by school principals who are asked to consider the overall situation of the school. Principals report, for instance, on the socio-economic composition of the student body, a variable that is heavily used in the report. Other variables such as school location (i.e. schools located in cities versus rural schools) and school governance (i.e. privately managed schools versus publicly managed schools) can also be indirectly informative about the characteristics of students attending them. However, the sorting of different students in rural or urban schools, or in public and private schools, is likely to vary across countries. In many countries, for example, the type of school management (i.e. private versus public) can be an important factor in explaining the segregation of students according to their socio-economic background (OECD, 2019[25]).

The implicit assumption underlying the analyses in this report is that all students in a given school are equally "exposed" to all the teachers in the school (or, equivalently, that students are randomly sorted into classes). The validity of this assumption varies across countries depending on the particular institutional arrangements governing class formation, the assignment of teachers to classes, and whether such arrangements change from grade to grade.

Can TALIS 2018 data, which was collected before the COVID-19 pandemic, provide relevant insights into today's digital divides?

This report draws on data that were collected in 2018;[3] that is, before the outbreak of the COVID-19 pandemic. Teachers' ability today to integrate ICT into teaching and learning is clearly different from what it was before school closures. This is true as well for schools' digital infrastructure. Prior to the pandemic, digital technology was one of many tools teachers could rely on. However, with schools closures, ICT became the only tool at teachers' disposal for teaching their students. As teachers and students have adapted to remote learning during the pandemic, teachers are using ICT much more and their technical skills have increased significantly (OECD, 2021[3]; OECD, 2021[38]). Many education systems have also enhanced teacher training on using digital tools and invested in ICT equipment and digital learning platforms (OECD, 2021[3]).

While digital technology has become key in teaching and learning, school closures have also highlighted the continued presence of digital divides. Although many countries implemented remedial measures targeting disadvantaged students, such as mentoring and homework support, there is evidence that learning losses during school closures were the most severe among marginalised students (OECD, 2021[3]). Studies from England (United Kingdom), France and the Netherlands show that disadvantaged students have suffered greater learning losses than their peers because of school closures (OECD, 2021[3]). With the pandemic putting the spotlight on inequalities in digital learning, TALIS 2018 data provide important insights into the extent and nature of these digital divides.

Overview of the main findings

Do students have equitable access to effective teachers?

While probably all students and parents know (or would claim to know) how effective their teachers are, it is difficult for researchers to identify effective teachers on the basis of observable, easy-to-access characteristics: teaching is a complex activity and hard to capture through surveys. Based on the best available research evidence, the TALIS questionnaire elicits information on a range of teacher characteristics and teaching practices that are robustly associated with effective teaching and better student performance (Ainley and Carstens, 2018[37]). The characteristics examined in this report are teachers' years of experience, the content of their initial education, and self-efficacy. Teaching practices that are analysed include cognitive activation, clarity of instruction, and classroom management skills, in particular the ability to maximise time devoted to actual teaching.

In all countries and territories participating in TALIS, there is evidence of clustering across schools of teachers with similar characteristics and practices related to effective teaching such as experience and time spent on actual teaching (see Tables 2.3 and 2.12). More often than not, teachers who are experienced and teachers who maximise instruction time work in schools with a high share of students from a socio-economically advantaged background. Less clear-cut are the patterns of sorting between public and private schools, and between urban and rural schools. The sorting of teachers along other characteristics and practices of effective teaching such as the content of their initial education, self-efficacy, cognitive activation and clarity of instruction is less prevalent (see Tables 2.5, 2.6, 2.8 and 2.10).

Students' access to experienced teachers

Experienced teachers are on average more effective in raising the performance of their students (Papay and Kraft, 2015[39]). The literature on this issue is abundant, in part because experience is very easy to observe and therefore an important and easy-to-use proxy for informing policies. In many of the countries participating in TALIS, experienced teachers (those with more than ten years of teaching experience) are more likely than their less experienced colleagues (those who have ten years or less of teaching experience) to work in advantaged schools that have a low concentration of students coming from socio-economically disadvantaged homes (10% or less of the student body) (Table 1.1). There are, however, exceptions to this general pattern: in Colombia, Shanghai (China) and Israel, experienced teachers are actually more likely to work in disadvantaged schools that have a high concentration of socio-economically disadvantaged students (more than 30% of the student body). And, in the majority of countries, differences between advantaged and disadvantaged schools are very small or not statistically significant.

Table 1.1. Snapshot of students' access to effective teachers, by school characteristics

Countries and territories with a significant difference, results based on responses of lower secondary teachers and principals

	By concentration of students from socio-economically disadvantaged homes[1]		By school type		By school location	
	Disadvantaged schools have **higher** share of…	Disadvantaged schools have **lower** share of…	Public schools have **higher** share of…	Public schools have **lower** share of…	Rural schools have **higher** share of…	Rural schools have **lower** share of…
Experienced teachers	PRT, CSH, COL, BRA, ISR, ARE	EST, HUN, VNM, ROU, FRA, SWE, BFL, BEL, USA, AUS, ENG, CAB, SAU, TUR	COL, ARE, VNM, PRT, ITA, GEO, SWE, MLT, CZE, BRA, SVK, MEX, CSH, TUR, NOR	BEL, BFL, KOR, AUS, NZL, SGP	ARE, AUT, NOR, USA	CHL, ESP, MEX, SAU, ROU, TUR
Time spent on actual teaching	CSH	CAB, NZL, DNK, AUS, USA, FRA, BFL, BGR, AUT, SWE, JPN, ENG, ESP, BEL, SAU, PRT, LTU, TUR, HUN	ITA, JPN	ARE, BFL, BFR, FRA, ESP, AUT, BEL, PRT, BRA, FIN, NZL, DNK, AUS, KAZ, SGP,	COL, ESP, FIN, SVN, TUR, DNK, MEX, NOR, AUT	LTU, HUN, KAZ, AUS
Comprehensively trained teachers	FRA, CSH, ENG, AUT, ISR, ITA, CABA	BFL, BEL, ESP	VNM, JPN, KAZ, SWE, ITA, CABA, FRA, NZL	ARE, DNK, BEL, BFL	BRA, ROU, HRV, HUN, KAZ	-
Teachers with high self-efficacy	ZAF	ESP, BEL	ABA, NOR, KAZ, CHL	FRA, MEX, ARE, BEL, ESP, FIN, SGP	CHL	FRA, ITA, FIN, LTU, EST, AUS, SWE
Cognitive activation practices	-	AUT, ISR, LTU, PRT	CHL, KAZ	PRT, ARE, CSH, CZE, SGP, FIN	TUR	ARE, LTU, NOR, EST, AUS
Clarity of instruction practices	CHL, AUS	-	ITA, AUS, USA, CHL, CABA, JPN, SVK, NZL, KOR, HUN, AUT, BEL	FIN, SGP	ZAF, ROU, HUN	LTU, SWE, SVN, EST, FIN, USA, CAB

Note: Countries are referred to by their three-letter country codes, based on the International Organization for Standardization (ISO) 3166 standard (see https://www.iban.com/country-codes). The letter codes used for territories are: CABA: Ciudad Autónoma de Buenos Aires (Argentina); CAB: Alberta (Canada); BFL: Flemish Community of Belgium; BFR: French Community of Belgium; ENG: England (United Kingdom); CSH: Shanghai (China).
1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal 10% of students from socio-economically disadvantaged homes.
Source: OECD, TALIS 2018 Database, Tables 2.3, 2.5, 2.6, 2.8, 2.10 and 2.12.

Similar results emerge when comparing public and private schools (Table 1.1). Experienced teachers are generally more likely to work in public schools, and in some countries the differences are very large: in Colombia, for instance, the share of teachers with more than ten years of experience teaching in public schools exceed the share in private schools by almost 30 percentage points (see Table 2.3).

Differences according to school location are less common (Table 1.1) but in the few countries where they exist, they tend to be large. In Turkey, for instance, the share of experienced teachers in urban schools is 34 percentage points higher than in rural schools (see Table 2.3). The United Arab Emirates are an example in the opposite direction, with experienced teachers more likely to work in rural schools.

Students' access to teachers who maximise instruction time

More instruction time during class translates into higher student achievement (Carroll, 1963[40]; Muijs et al., 2014[41]; Schmidt, Zoido and Cogan, 2014[42]). This result has been shown to hold across different settings, using different data and different empirical strategies. TALIS allows measuring the instruction time to which students are exposed by asking teachers how their working time is allocated between different tasks such as administrative tasks, keeping order and actual teaching. Data from the TALIS-PISA linking study show that students of teachers who spend a larger share of class time on actual teaching perform better in the PISA assessment (OECD, 2021[43]). The literature on teaching quality has stressed the ability of teachers to maximise instruction time as one important component of classroom management (Ainley and Carstens, 2018[37]; Kane et al., 2010[44]; Stronge et al., 2007[45]). Yet, the amount of time that can be devoted to instruction does not depend exclusively on the choices teachers make about how they allocate their time or teachers' ability to keep order in the class. It also depends on classroom environment and students' behaviour. For most teachers the share of class time spent on instruction varies in different schools and even with different students in the same school.

Teachers who are in the top quarter of the national distribution in terms of the share of class time they spend on actual teaching are far from being equally represented across schools (Table 1.1). Differences in the share of class time spent on actual teaching are affected by classroom environment, which can be more challenging in certain schools than others.

Divides between advantaged and disadvantaged schools are particularly large (above 20 percentage points) in Alberta (Canada), Denmark, and New Zealand (see Table 2.12). Shanghai (China) is the only territory in which disadvantaged schools are more likely to employ teachers in the top quarter of the distribution in terms of share of working time spent teaching. Differences between private and public schools are largest in Singapore (32 percentage points), Kazakhstan (17 percentage points), Australia (16 percentage points), Denmark (15 percentage points) and New Zealand (15 percentage points). The only countries in which public schools are more likely than private schools to employ teachers who spend a large share of their time actually teaching are Italy and Japan. Differences according to school locations are less common. In nine countries, rural schools are more likely to employ teachers who spend a large share of their time in actual teaching, with differences particularly large (20 percentage points or above) in Colombia and Spain. Differences are in favour of urban schools in Australia, Hungary, Kazakhstan and Lithuania (Table 1.1).

Students' access to comprehensively trained teachers

The type and quality of teacher education are important determinants of teacher knowledge. These, in turn, have been found to be significantly related to student achievement (Baumert et al., 2010[46]). TALIS does not contain information on teacher knowledge or on the quality of initial teacher education but it does ask teachers many questions about the content of their initial training. The complexity of teaching and rapid changes in society (Cerna et al., 2021[28]) require teachers to be trained in a wide range of issues: important dimensions captured by TALIS include content; pedagogy; classroom practices; cross-curricular skills; teaching in a mixed-ability setting; and classroom management. Not all teachers received a comprehensive initial education, including all the aforementioned dimensions, though, and many had to learn their skills on the job: on average across OECD participating countries, only about 40% of teachers received a comprehensive initial education (see Table 2.5).

These teachers do not appear to be more or less likely to teach in certain types of schools: differences between advantaged and disadvantaged schools, between private and public schools, or between urban and rural schools are only apparent in a handful of countries, and they are often small in magnitude (Table 1.1). More often than not, comprehensively trained teachers are more likely to teach in disadvantaged schools: this is notably the case in Ciudad Autónoma de Buenos Aires (hereafter CABA [Argentina]), Israel and Italy.

Students' access to teachers with high self-efficacy

Self-efficacy refers to individuals' perceptions of their capabilities of performing a task. Such perceptions can influence actual behaviours and, thus, performance. A vast literature in education has showed robust positive association between self-efficacy and performance for both students and teachers. TALIS elicits teachers' self-efficacy beliefs by asking them to assess their perceptions of their ability to perform well in a range of tasks related to classroom management, instruction, and students' engagement.

In the majority of countries participating in TALIS 2018, there are essentially no differences between different types of schools in employing teachers with high self-efficacy (defined as those in the top quarter of the national distribution of the self-efficacy scale) (Table 1.1). The differences that emerge in a few countries are mostly related to the type of schools (with private schools being more likely to employ teachers with high self-efficacy) and school locations (whereby teachers with high self-efficacy are more likely to work in urban schools).

Students' access to cognitive activation

Cognitive activation consists of instructional activities that require students to evaluate, integrate and apply knowledge within the context of problem solving (Lipowsky et al., 2009[47]). The use of cognitive activation has been shown to be related to higher student achievement (Bellens et al., 2019[48]; Le Donné, Fraser and Bousquet, 2016[32]).

In most countries, differences between advantaged and disadvantaged schools in the share of teachers that heavily rely on cognitive activation are not statistically significant: only in four countries (Austria, Israel, Lithuania and Portugal) is the share of teachers who frequently rely on cognitive activation higher in socio-economically advantaged than disadvantaged schools (Table 1.1). Cognitive activation practices are more common in private schools in six TALIS participating countries and territories, with large differences in Finland (21 percentage points), Singapore (14 percentage points) and the Czech Republic (11 percentage points) (see Table 2.8). In only six countries are some differences between urban and rural schools observed. In Australia, Estonia, Lithuania, Norway and the United Arab Emirates, cognitive activation practices are more likely to be used in urban schools, while in Turkey the reverse pattern is observed.

Students' access to clarity of instruction

Clarity of instruction is conceptualised in TALIS as the ability to set clear and comprehensive instruction and learning goals; to connect new and old topics; and to provide students with a summary of the lesson at the end (Ainley and Carstens, 2018[37]). Various studies have shown how this practice is related to positive student outcomes, including learning motivation, achievement and satisfaction (Hines, Cruickshank and Kennedy, 1985[49]; Seidel, Rimmele and Prenzel, 2005[50]).

In 12 countries and territories, teachers who rely most on clarity of instructions tend to be concentrated in public schools (Table 1.1). The difference with respect to private schools is largest in Italy (15 percentage points), Australia (13 percentage points) and the United States (13 percentage points) (see Table 2.10). Finland and Singapore are the only countries where clarity of instruction is more frequently adopted in private schools. Fewer differences emerge according to school location. Teachers tend to more frequently adopt clarity of instruction in urban schools in seven countries, while in three countries such practices are more common in rural schools. Differences according to the socio-economic composition of the student body are present in only two countries (Australia and Chile); in both cases, they are to the benefit of disadvantaged schools whose teachers are more likely to heavily rely on practices pertaining to clarity of instruction.

Do students have equitable access to digital learning in school?

Students' access to effective digital learning at school depends on various factors. Having adequate ICT infrastructure at school such as software, computers, laptops, smart boards and sufficient Internet access is essential for effective digital learning in school. However, it is equally important that students have access to teachers who are trained in and feel capable of using ICT. Past studies have shown that having access to technology will not improve student learning in itself; effective integration of technology into teaching and learning requires teachers who are well trained and able to use digital tools for instruction (Fraillon et al., 2019[51]; OECD, 2021[52]; OECD, 2019[53]; OECD, 2015[54]). Although past research based on PISA data show that ICT use at school does not automatically lead to better student outcomes – use of ICT that is either too limited or excessive can be associated with lower student achievement (Borgonovi and Pokropek, 2021[55]; OECD, 2019[53]; OECD, 2015[54]) – teachers' and students' ability to make the most of ICT is reinforced by regular and judicious use of digital technology in the classroom.

Students' access to ICT equipment

One of the reasons for education systems to invest in schools' ICT infrastructure is to compensate for the limited access to ICT tools and at-home Internet many disadvantaged students have (Bulman and Fairlie, 2016[56]; OECD, 2015[54]). Yet, in line with findings based on PISA 2018 data (OECD, 2020[57]), TALIS results show that students' access to adequate ICT infrastructure varies according to the type of school they attend (Table 1.2). Namely, students who attend public schools and schools with a high share of disadvantaged students tend to have more limited access to adequate ICT infrastructure. On average across OECD countries, the share of principals who reported that the school's capacity to provide quality instruction was hindered by a shortage in or inadequacy of digital technology for instruction is higher in socio-economically disadvantaged schools than in advantaged schools (by 9 percentage points), and also in public schools than in private schools (by 12 percentage points) (see Table 3.3). The share of schools where providing quality instruction is hindered by insufficient Internet access is 9 percentage points higher in socio-economically disadvantaged schools than in advantaged schools, and 14 percentage points higher in public schools than in private schools on average across OECD countries (see Table 3.4). These results indicate that socio-economically advantaged schools and private schools tend to have more resources to maintain and improve the schools' ICT infrastructure.

School location is found to matter more for the quality of schools' Internet access than for ICT equipment. In most TALIS participants, there are no differences in the availability and quality of digital equipment between schools located in cities and those situated in rural areas (Table 1.2). In contrast, the share of principals who reported that the school's capacity to provide quality instruction was hindered "quite a bit" or "a lot" by insufficient Internet access is 7 percentage points higher in rural schools than in schools located in cities on average across OECD countries and territories (see Table 3.4). These results may reflect the general gaps in connectivity and Internet access that persist between urban and rural areas in virtually all countries (International Telecommunication Union, 2020[58]). Moreover, the funding of rural schools often does not reflect the higher costs of delivering education programmes and services in remote areas (OECD, 2017[59]). It can also be highly dependent on the local tax base, which tends to be lower in rural areas (Echazarra and Radinger, 2019[60]).

Table 1.2. Snapshot of students' access to digital learning at school, by school characteristics

Countries and territories with a significant difference, results based on responses of lower secondary teachers and principals

	By concentration of students from socio-economically disadvantaged homes[1]		By school type		By school location	
	Disadvantaged schools have **higher** share of…	Disadvantaged schools have **lower** share of…	Public schools have **higher** share of…	Public schools have **lower** share of…	Rural schools have **higher** share of…	Rural schools have **lower** share of…
Adequate ICT equipment	JPN, SWE, CSH	AUT, ROU, PRT, USA, ITA, AUS, COL, ZAF, MEX, CABA	-	MEX, CABA, VNM, COL, PRT, BRA, JPN, ARE, KAZ, USA, AUS, BEL, ESP, DNK	AUT	COL, ARE, KAZ, RUS, BGR
Sufficient Internet access	CSH	PRT, AUS, AUT, ZAF, MEX, COL, CABA	-	CABA, MEX, COL, ITA, VNM, ARE, KAZ, ZAF, BRA, PRT, JPN, AUS, HUN, GEO, BEL, DNK, ESP, SGP	AUT	CAB, COL, MEX, ITA, ARE, KAZ, RUS, TUR, SAU, GEO
Teachers who had formal training in the use of ICT for teaching	VNM, ARE, ENG, AUS, SWE, FRA	COL, TUR	JPN, KAZ, FRA, SGP, TUR, ENG, VNM	PRT, ZAF, COL	ROU, HRV, SVN, ENG, TUR, KAZ, SWE	LVA
Teachers who participated in professional development in ICT skills	KAZ, VNM, FRA	EST, ENG, BGR, ZAF, SWE, TUR	FRA, NOR, KAZ	MEX, AUS, BFL, BEL, BRA, ZAF	ESP, HRV	BEL, AUS, NZL
Teachers with high self-efficacy in the use of ICT for teaching	CAB	BEL, MEX, COL, AUT, ZAF, BRA, CABA	NOR, VNM, CZE, CHL, BFR	ARE, SVK, AUS, COL, ESP, FIN, ZAF, BEL, GEO, BRA, MEX, SGP	AUT, SVK, CHL, HUN, CZE, PRT	TUR, AUS, USA
Teachers who use ICT for teaching on a regular basis	BFL, CAB	VNM, ENG, AUS, ARE	BFL, CHL, TUR	MEX, FRA, MLT, CSH, FIN, SVK, BRA, ARE, ESP, AUS, SGP	CHL, AUT, ITA	GEO, TUR, USA, VNM

Note: Countries are referred to by their three-letter country codes, based on the International Organization for Standardization (ISO) 3166 standard (see https://www.iban.com/country-codes). The three-letter codes used for territories are: CABA: Ciudad Autónoma de Buenos Aires (Argentina); CAB: Alberta (Canada); BFL: Flemish Community of Belgium; BFR: French Community of Belgium; ENG: England (United Kingdom); CSH: Shanghai (China).

1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal 10% of students from socio-economically disadvantaged homes. Source: OECD, TALIS 2018 Database, Tables 3.3, 3.4, 3.5, 3.7, 3.12 and 3.15.

Students' access to teachers with high self-efficacy in the use of ICT

In all TALIS participants, there is evidence for clustering of teachers who are trained in and feel capable of using ICT (see Tables 3.5, 3.6, 3.7, 3.8 and 3.12). On average across the OECD, around one-third of teachers who were trained in and feel capable of using ICT would need to move to another school so that the distribution of teachers across schools mirrors the overall teacher population. However, the uneven allocation of teachers with certain characteristics does not necessarily mean that a school system is inequitable. Education systems may deliberately allocate more resources to disadvantaged schools to remove obstacles for students that they can do nothing about. This includes the problem of limited access to digital learning resources at home.

Looking more closely at the types of schools in which teachers who are trained in and feel capable of using digital technology tend to concentrate shows a mixed pattern. There are not many countries and territories where the share of teachers who were trained in ICT skills either in service or as part of their initial education varies across different types of schools. Teachers with high self-efficacy in ICT use tend to work in private schools (Table 1.2). The share of teachers who feel they can support student learning through the use of digital technology "quite a bit" or "a lot" tends to be higher in private schools than in public schools in almost one-fourth of the countries and territories participating in TALIS. Teachers in private schools may report higher self-efficacy in ICT use because private schools tend to have better ICT infrastructure. In any case, the share of teachers with high self-efficacy in the use of digital technology tends to be higher in schools where the quality of instruction is not hindered by inadequate digital technology (see Table 3.1).

The share of teachers who feel they can support student learning through the use of ICT "quite a bit" or "a lot" is also higher in socio-economically advantaged schools than in disadvantaged schools in seven education systems (Table 1.2). In Austria, Belgium, Brazil, CABA (Argentina), Colombia, Mexico and South Africa, the share of teachers with high self-efficacy in ICT use is higher in socio-economically advantaged schools than in disadvantaged schools. In these countries and territories, students from socio-economically disadvantaged backgrounds, who tend to be less exposed to digital learning at home, are also less likely to have access to teachers with high self-efficacy in ICT use for instruction at school.

Students' access to teachers who use ICT for teaching on a regular basis

Similar to the distribution of teachers who were trained in and feel capable of using ICT, there is also evidence in all TALIS participants of clustering of teachers who "frequently" or "always" let students use ICT for projects or class work (see Table 3.15). On average across the OECD, around one-third of teachers who regularly use ICT in the class would need to move to another school in order to distribute this type of teachers evenly across schools.

Differences across schools in the use of ICT for teaching tend to be the most pronounced between private and public schools (Table 1.2). In almost one-fourth of the countries and territories participating in TALIS, the share of teachers who reported using ICT for projects or class work on a regular basis is higher in private than public schools. Thus, in several education systems, students attending private schools are more likely to be exposed to digital learning at school on a regular basis than their peers who attend public schools. Teachers in private schools may use ICT for instruction more regularly since private schools tend to have better ICT infrastructure. In addition, students attending private schools may have better access to digital learning resources at home, which, in turn, can help teachers implement digital learning at school more smoothly and effectively. In addition, in a few education systems such as Australia, England (United Kingdom), the United Arab Emirates and Viet Nam, there is evidence that the share of teachers who regularly use ICT in their teaching is higher in socio-economically advantaged schools than in disadvantaged schools.

The differences between schools in the frequency with which teachers use ICT once teacher and school characteristics are taken into account suggests that reallocating teachers and improving schools' ICT infrastructure may not be sufficient in addressing inequities in students' access to digital learning in school. Across all TALIS participants except for Malta, differences between schools in the frequency of ICT use remain significant even after accounting for teacher characteristics such as years of teaching experience, self-efficacy, initial education and continuous professional development in the use of ICT as well as schools' digital infrastructure (see Table 3.16). However, when teachers collaborate with each other,[4] it is more likely they will regularly let students use ICT for projects or class work (see Table 3.17). This holds true in around half of the countries and territories participating in TALIS and on average across the OECD after accounting for teacher characteristics;[5] teachers' training in the use of ICT; and classroom composition. This means that while digital technology fosters teacher collaboration by providing better tools for collaborative work, collaboration among teachers itself can help increase the use of ICT in school.

Teacher allocation and learning divides

Despite significant efforts to narrow disparities in students' outcomes in the recent past, students' socio-economic background remains strongly correlated with their academic performance (OECD, 2019[2]; OECD, 2018[6]) It is also clear that teachers with various characteristics and practices are not distributed randomly across schools and can be concentrated in certain schools depending on school characteristics such as socio-economic profile and location (see Chapters 2 and 3). To see how the sorting of effective teachers is related to socio-economic inequalities in student outcomes, one can correlate TALIS measures of teacher allocation with PISA-based measures of inequalities in learning outcomes at the system level. This can provide valuable insights for policy directions aimed at reducing socio-economic inequalities in student outcomes. In addition, it is also worth investigating whether certain system-level policies are associated with more even and equitable sorting of teachers across schools. This means exploring whether factors like school competition and school autonomy in hiring and dismissing teachers, and determining teachers' salaries can be effective policy levers in addressing inequities in teacher sorting (see Chapter 4).

How access to effective teachers is related to socio-economic inequality in student performance

At the system level across TALIS countries and territories, the mean reading score in PISA[6] tends to be negatively associated with the dissimilarity index for experienced teachers (i.e. teachers with more than ten years of teaching experience) (linear correlation coefficient (r) = -0.44) (see Table 4.1). That is, the uneven (non-random) distribution of experienced teachers is associated with lower average reading scores at the system level. This suggests that experienced teachers are not directed to the schools that need them most and that reallocating experienced teachers could help increase the average reading scores of students. As highlighted in Chapter 2, experienced teachers are more likely to work in schools where there are few socio-economically disadvantaged students (10% or less of the student body) than in schools where disadvantaged students constitute more than 30% of the student population in many of the countries participating in TALIS. The system-level correlation also shows that an uneven distribution of experienced teachers is negatively associated (linear correlation coefficient (r) = -0.42) with the PISA reading score of the most disadvantaged students in the country, here defined as the bottom quarter of socio-economic status in that country. Disadvantaged students tend to have lower reading scores when experienced teachers are not evenly distributed but, rather, clustered in schools that are predominantly socio-economically advantaged.

Meanwhile, in school systems where teachers who spend more class time on actual teaching are concentrated in certain schools, the mean reading score of students tend to be lower, especially for the most disadvantaged students (see Table 4.1). The dissimilarity index for teachers who are in the top quarter based on class time spent on actual teaching and learning is negatively correlated with the mean reading score of students in the bottom quarter of socio-economic status (linear correlation coefficient (r) = -0.36). Thus, in education systems where teachers who spend more class time on actual teaching are more unevenly distributed and clustered in schools that are predominantly socio-economically advantaged, students, especially those from disadvantaged backgrounds, tend to perform worse in reading. Based on findings in Chapter 2, large and systematic differences are observed between different types of schools in the share of teachers who spend a large share of class time on instruction. Notably, teachers that spend more class time on actual teaching are more likely to work in advantaged schools as well as private schools. However, the system-level relationship does not necessarily mean that when disadvantaged students are taught by teachers who maximise actual teaching time it will improve their performance.

There might be other factors that play a part; for example, advantaged schools might have fewer disciplinary problems in the classroom overall, which allows teachers to spend more time on actual teaching instead of classroom management. In general, the share of class time teachers can spend on actual teaching also depends on the school's student composition.

According to the system-level correlational analysis, disadvantaged students tend to have just as much or more opportunity to learn digital literacy skills (such as detecting if the information read is subjective or biased) at school in those education systems where there is a more even distribution of teachers with high self-efficacy in ICT use (linear correlation coefficient (r) = 0.49) and who "frequently" or "always" use ICT for instruction (linear correlation coefficient (r) = 0.45) (see Table 4.2). As highlighted in Chapter 3, the share of teachers with high self-efficacy in ICT use and who use ICT for instruction on a regular basis is larger in private than public schools in almost a quarter of countries and territories participating in TALIS. Thus, the dissimilarity index may partly reflect an inequitable distribution of teachers who feel self-efficacious in ICT and use it regularly for teaching. Although causality cannot be determined, the findings of the system-level correlational analyses suggest that a more even distribution of teachers who have high self-efficacy in ICT use and engage in the use of digital technology on a regular basis can give disadvantaged students the same opportunity to learn digital literacy skills as their peers from socio-economically advantaged families.

How access to effective teachers is related to school autonomy and competition

Overall, the association between system-level policies such as school competition and school autonomy in hiring, dismissing and determining teachers' salaries, and TALIS measures of teacher allocation is weak. However, there is an exception to this pattern when it comes to the sorting of experienced teachers across schools. Across TALIS participants, the larger the share of principals within a country who report that their school has autonomy in appointing or hiring teachers, the more evenly experienced teachers tend to be distributed across schools (linear correlation coefficient (r) = -0.51) (see Table 4.3). Differences in the share of principals within a country who report that their school has autonomy in appointing or hiring teachers account for 26% of the differences in the dissimilarity index for experienced teachers. Similarly, the higher the share of principals within a country who report that their school has autonomy in dismissing or suspending teachers from employment, the more evenly experienced teachers tend to be distributed across schools (linear correlation coefficient (r) = -0.47). These findings suggest that higher school autonomy in staffing practices can result in a more equal distribution of teachers across schools. Past research has found that higher levels of school autonomy in managing teachers tend to produce a more equitable sorting of teachers across schools (OECD, 2018[10]). Yet, there are two caveats to this: disadvantaged schools may need monetary or other support to be able to attract and retain the teachers they want (OECD, 2018[10]). And school autonomy in staffing practices might only translate into greater equity in student performance if it is accompanied by higher levels of accountability, past findings suggest (OECD, 2018[10]; OECD, 2016[61]; Torres, 2021[62]). And, last of all, in looking at individual countries, there appear to be outliers among countries that report lower school autonomy. This indicates that policy makers should consider a range of policy tools.

Finally, system-level analysis shows that differences between disadvantaged and advantaged schools in terms of the share of teachers with high self-efficacy in ICT use is negatively correlated with the share of principals who reported that two or more schools in their district were in competition for students (linear correlation coefficient (r) = -0.40) (see Table 4.4). When there is more competition for students among schools, teachers with high self-efficacy in the use of digital technologies tend to sort into advantaged schools. Empirical evidence on the effect of school competition on teacher quality is mixed. There are studies showing that "more competition tends to increase teacher quality, particularly for schools serving predominantly lower-income students" (Hanushek and Rivkin, 2003, p. 45[63]). This may be the case if competition enhances the productivity of disadvantaged schools more than it benefits advantaged schools. Competition can provide incentives for considerable improvements in disadvantaged schools' hiring, retention, monitoring and other teacher management practices. However, increased competition across schools can also result in more disparities in teacher quality in favour of socio-economically advantaged schools. In general, these schools are assumed to be more effective in attracting and retaining good teachers. Yet, as with all other findings presented in this report, one should be cautious in interpreting the results, which are only correlational and not causal. The observed system-level correlation between school competition and the differences in the share of teachers with high self-efficacy in ICT use between disadvantaged and advantaged schools may be a result of mediating factors. For example, in education systems where school competition is common, the gap in the quality of ICT infrastructure between advantaged schools and disadvantaged schools may be larger, which, in turn, is related to the differences in teachers' self-efficacy in ICT use between disadvantaged and advantaged schools.

What these findings imply for policy

The results of this report suggest that effective teachers do not necessarily work in the schools that need them most. The analyses also show that inequities in teacher allocation can be related to socio-economic inequality in student performance. This section highlights some directions for education policies that could lead to more equitable teacher allocation, and, potentially, to a decrease in socio-economic inequalities in student outcomes. It focuses on policies aiming at a better match between teachers and schools. The policies highlighted touch upon issues around school autonomy in teacher management; teacher preferences and incentives; criteria and processes guiding the recruitment of teachers; support for teachers working in challenging environments; and funding allocation for schools. These policy directions draw mainly on policy options put forward in the OECD Review of Policies to Improve the Effectiveness of Resource Use in Schools (School Resources Review), in particular in the report titled: *Working and Learning Together: Rethinking Human Resource Policies for Schools* (OECD, 2019[64]).

As one would expect, there is no one-size-fits-all approach to designing policies. The right policy mix depends on the specific context of each country's education system. Therefore, the policy directions highlighted in this section should be considered in each national context according to country-specific challenges and constraints.

Ensure that all schools have the capacity to recruit and retain effective teachers

The degree of school autonomy in recruitment varies by countries. There are education systems where schools have very limited influence on hiring decisions (OECD, 2019[64]). However, school-level hiring can improve the matching of teachers to the needs and profiles of particular schools and their students (OECD, 2019, p. 27[64]). As school-based recruitment allows teachers themselves to choose their workplace; have personal contact before the decision is taken; and build a sense of commitment to their school, it can also result in higher job satisfaction and lower teacher turnover and attrition (OECD, 2019[64]).

Yet, school autonomy in staffing decisions may lead to more inequitable allocation of qualified and experienced teachers as advantaged schools may have more resources and be more efficient in their recruitment processes. Indeed, not all schools have the capacity and expertise to effectively manage the selection and recruitment of their teachers (OECD, 2019[64]). And yet, the findings of this report, which are in line with previous OECD study (2018[10]), suggest that schools' increased autonomy for managing teachers is associated with a more even allocation of experienced teachers (see Table 4.3). School-based teacher recruitment can lead to more effective and equitable teacher allocation especially when all schools, including disadvantaged ones, have sufficient resources and the capacity to properly screen and select applicants. Thus, schools that are most in need may require additional funding to improve their leadership, and managerial and administrative capacity, and compete against other schools in attracting effective teachers. In the United Kingdom, for instance, disadvantaged schools have access to financial support to help them recruit and retain effective teachers (see Box 4.1). Alternatively, schools can also collaborate with the education administration and create a hybrid recruitment system. For example, schools could participate in interviews managed by the administration. They could make the final selection among candidates who have already been interviewed and ranked in a central process, and who have expressed interest in working at their school. Schools can also directly select a part of their teaching staff while the administration remains in charge of recruiting and assigning the remaining part (OECD, 2019, p. 251[64]). But for more equitable teacher allocation to translate into more equitable student outcomes, greater school autonomy needs to be combined with adequate accountability mechanisms (OECD, 2018[10]; OECD, 2016[61]; Torres, 2021[62]).

Nevertheless, equitable teacher allocation can also be observed in education systems with little school autonomy (OECD, 2018[10]). In Japan, more experienced teachers tend to be evenly distributed across schools even though only 12% of school principals reported autonomy in appointing or hiring teachers (see Figure 4.6). In Japan, the use of a mandatory mobility scheme whereby teachers are regularly assigned to new schools based on their age and gender may play a role in achieving an even allocation of experienced teachers (see Box 4.4). Still, teacher preferences on where to work and the way recruitment criteria is designed are generally important in achieving an effective and equitable distribution of teachers.

Provide incentives for teachers to work in high-need areas

Teacher preferences play an important role in how teachers are distributed across schools, and can be shaped by financial and other incentives. Although teachers often prefer to work in socio-economically advantaged schools as they tend to provide more favourable working conditions, financial incentives to work in areas of need – either in socio-economically disadvantaged schools or in rural areas – can help in directing effective teachers where they are most in need (OECD, 2019[64]). Education systems could offer higher salaries, differential pay for particular expertise, or scholarships and subsidies for teachers working in disadvantaged schools or schools located in rural areas (OECD, 2019, p. 253[64]). In Brazil, for instance, teachers who are willing to work in disadvantaged schools are offered salary premiums (see Box 4.4). In England (United Kingdom), mathematics teachers working in challenging schools can get retention payments (see Box 4.1). In Chile, there are monetary incentives in the form of special allowances to attract teachers and school leaders to remote areas. They are also used to encourage teachers to take on management roles in rural schools (OECD, 2018, p. 162[65]). Yet, the efficacy of financial incentives are highly dependent on the general context of teacher recruitment and career progression, and they are relatively rarely applied among OECD countries (OECD, 2019[64]). Therefore, the introduction of financial incentives requires adequate evaluation and monitoring as a way to facilitate implementation and potential adjustments.

Although financial compensation matters, there are other important factors that shape teachers' choice. Teachers tend to be highly motivated by the intrinsic benefits and social utility of teaching. Around 90% of teachers in the OECD become teachers because they want to influence children's development and contribute to society (OECD, 2019[8]). In addition, working conditions such as workload, preparation time and facilities as well as professional factors such as autonomy, opportunities for career progression, professional learning and a collegial and collaborative school climate can influence teachers' school choice. These are important non-financial incentives (OECD, 2019[64]). For example, in China, career-related incentives in the form of offering tenure track positions are used to attract teachers to remote areas (see Box 4.4).

Results related to inequities in students' access to digital learning at school point to various policy options that rely on non-monetary incentives such as professional development activities focusing on ICT use for school staff and fostering a collaborative culture among teachers, which can boost ICT use (see Chapter 3). These, along with improvement of schools' ICT infrastructure, can attract teachers to schools in need and address digital divides. In light of lessons learned in the early stages of the COVID-19 pandemic, Germany and Spain allocated funds to provide digital devices and connectivity to education institutions with priority given to disadvantaged schools (OECD, 2021[66]). In Chile, there have been programmes since 2000 that provide rural schools with ICT infrastructure, including Internet access. Chile has also taken action to improve teachers' working conditions and opportunities for collaboration in rural and remote areas (OECD, 2018, p. 164[65]).

Review criteria for recruitment and transfers of teachers

There are education systems in which teachers with permanent contracts and higher levels of seniority and qualifications have first say on the schools they would like to work at. Teacher seniority, qualifications and contractual status are important criteria in the recruitment and allocation of teachers. Combined with teachers' preferences to work in advantaged schools, this tends to lead to inequitable teacher allocation (OECD, 2019[64]). As also shown by this report, more experienced teachers tend to work in socio-economically advantaged schools while their less experienced colleagues start their careers in more challenging schools (see Table 2.3). Such a mismatch between schools' (and students') needs and teachers' skills may also result in novice teachers leaving the profession (OECD, 2019[64]). Education systems in which seniority, qualifications and contractual status have a large bearing on teacher recruitment and allocation could consider reducing the weight of these criteria. Alternatively, experience in difficult or remote schools can be given larger consideration in teachers' career progression (OECD, 2019, pp. 252-253[64]).

Provide support to teachers working in more challenging schools

Nudging effective teachers to work in challenging schools is one way to achieve a more equitable teacher allocation. Yet, education systems, in particular those with more centralised teacher allocation and compensation mechanisms, should also provide additional support for teachers who work in challenging schools. The support could focus on in-service training as well as mentoring and induction activities for those who are either new to the profession or just moved to a new school (OECD, 2018[10]; OECD, 2020[9]).

Education systems can facilitate teachers' participation in professional development by relying on incentives (e.g. covering costs or teaching duties) or adapting accountability measures such as teacher appraisal or school evaluation (OECD, 2021[66]). In the United Kingdom, there are policies in place that focus on improving the availability of professional development for teachers who work in disadvantaged areas (see Box 4.1). Regarding the form of professional development, school-embedded forms such as peer-learning opportunities (e.g. teacher coaching) tend to be more efficient in improving teaching practices and can significantly reduce the cost of training than more traditional activities (e.g. courses or seminars) (Kraft, Blazar and Hogan, 2018[67]; Opfer, 2016[68]). In terms of the content of in-service training, Estonia, which has a comprehensive national strategy for ICT use in schools, showcases the benefits of enhancing teachers' professional development in the use of ICT (see Box 4.3). Collaborative professional development is another cost-effective policy lever for providing in-service training while also initiating and extending a culture of collaboration within schools (Darling-Hammond, 2017[69]). In addition, as shown by the findings of this report, collaboration among teachers can also help in increasing the use of ICT in school (see Table 3.17).

Induction to teaching and mentoring are mechanisms to support teachers who are new to the school or the profession and, as a result, may face more challenges than their colleagues (OECD, 2019[70]). Chile provides examples for mentoring programmes (e.g. *Tutores para Chile*) where professional mentors observe trainee teachers during tutoring sessions with students and provide feedback on their professional practice (OECD, 2020, p. 64[71]).

Ensure equitable and transparent funding allocation for schools

Many of the policy directions mentioned above require that education systems have adequate funding to support schools and their teachers that are in need. However, disadvantaged schools or those located in rural areas often have limited resources. For example, the funds allocated to rural schools that are primarily based on student enrolment usually do not reflect the higher costs of delivering education programmes and services in remote areas (OECD, 2017[59]). Moreover, in some education systems, school funding by local authorities is highly dependent on the local tax base, which tends to be lower in rural areas (Echazarra and Radinger, 2019[60]).

To achieve an equitable teacher allocation it is necessary to also have an equitable funding allocation in place (OECD, 2019[64]). Namely, an equitable funding system should balance between regular and targeted funding. Funding formulas tend to account for schools' different resource needs by applying weights for the socio-economic characteristics, immigrant background and special educational needs of the student body and also for school location (OECD, 2017[59]). While a well-designed funding formula can be an efficient, equitable and transparent way to manage current expenditures such as teacher salaries, it is important to thoroughly monitor the additional funding directed towards schools, teachers and students at risk of underperformance (OECD, 2019, p. 252[64]). Although targeted funding can ensure responsiveness, the multiplication of targeted funding programmes can also lead to overlap, lack of co-ordination between different programmes, excessive bureaucracy and a lack of long-term sustainability for schools (OECD, 2017[59]). Policy responses to the COVID-19 crisis provide examples for targeted funding for schools that are most in need. In the 2020/21 academic year, schools in need in England (United Kingdom)[7] and the Netherlands received one-off financial support to ensure that all students make up for lost teaching time (OECD, 2020[71]).

In decentralised systems, in which sub-national authorities that depend on local taxes do not have adequate revenues or the capacity to meet the funding needs of their schools, well-designed fiscal equalisation mechanisms can be implemented (OECD, 2019[64]). In these systems, it is also important to align the revenue-raising and spending powers of sub-national authorities (OECD, 2017[59]). For example, in Nordic countries, local governments tend to have substantial control over personal income tax rates. However, it is important to note that setting such fiscal rules goes beyond the scope of the education system and should be considered in the broader context of fiscal transfers across the different levels of government (OECD, 2017, p. 89[59]).

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Notes

[1] Schools where more than 30% of students come from socio-economically disadvantaged homes are classified as "disadvantaged schools", and schools where less than 10% of the students are socio-economically disadvantaged are classified as "advantaged schools".

[2] A privately managed school is a school whose principal reported that it is managed by a non-governmental organisation (e.g. a church, trade union, business or other private institution). In some countries, the privately managed schools category includes schools that receive significant funding from the government (government-dependent private schools). A publicly managed school is a school whose principal reported that it is managed by a public education authority, government agency, municipality, or governing board appointed by the government or elected by public franchise. In the principal questionnaire,

this question does not make any reference to the source of the school's funding, which is reported in the preceding question.

[3] Southern Hemisphere countries were surveyed in 2017.

[4] The index of professional collaboration measures teachers' engagement in deeper forms of collaboration that involve more interdependence between teachers, including teaching jointly as a team in the same class, providing feedback based on classroom observations, engaging in joint activities across different classes and age groups and participating in collaborative professional learning.

[5] Teacher characteristics include teachers' self-efficacy in ICT use, years of teaching experience, gender and employment status.

[6] Reading was the focus domain in the 2018 round of PISA, which means it was tested in more detail than the other two domains, mathematics and science.

[7] England's (United Kingdom) Catch-up Premium is a one-off, universal payment of GBP 80 per student in mainstream schools and GBP 240 for those in special education settings (OECD, 2020, p. 64[71]).

2 Do students have equitable access to effective teachers and learning environments?

Teachers can have an enormous influence on the cognitive and socio-emotional development of their students. But there are significant differences in the extent to which teachers are able to help their students succeed. Such large observed variation in teachers’ effectiveness raises the question of which students have the opportunity to be taught by effective teachers. Building on the literature that identifies teachers’ characteristics and teaching practices that are robustly linked to effectiveness, this chapter looks at how strong teachers are distributed across schools, and which types of schools (and students) are more likely to benefit from them.

Highlights

- In all countries, teachers with similar characteristics and teaching practices tend to work together, in the same school or in schools with similar characteristics.
- There is a pattern of effective teachers sorting into schools with a large share of students from a socio-economically advantaged background. Less clear-cut are the patterns of sorting between public and private schools and between urban and rural schools.
- In many countries, experienced teachers are systematically sorted in such a way as to cater to socio-economically advantaged students. They are also more likely to work in public schools.
- Teachers who maximise their students' learning opportunities by spending more time on actual teaching in the classroom are also over-represented in socio-economically advantaged schools and private schools.
- Experienced teachers and teachers with high self-efficacy tend to allocate a higher share of classroom time to actual teaching. Ensuring a fairer distribution of teachers with these characteristics would likely reduce disparities between schools.

Introduction

Teacher quality is by far the most important benefit schools can provide to students. A large body of research literature shows that teachers have a powerful impact on students' outcomes (Aaronson, Barrow and Sander, 2007[1]; Rivkin, Hanushek and Kain, 2005[2]). It is long-lasting (Chetty et al., 2011[3]), and it is not limited to academic achievement or other cognitive outcomes. There is now robust evidence that teachers can also raise students' social and emotional skills (Blazar and Kraft, 2017[4]; Jackson, 2018[5]).

There is less consensus about what exactly makes a "good" teacher, however. Many researchers have struggled to identify teachers' characteristics and teaching practices that are robustly correlated with students' outcomes (Rivkin, Hanushek and Kain, 2005[2]). This is partly due to the fact that teaching is a complex and multidimensional activity. Different teachers are often good at different things, and measured teaching effectiveness can be influenced by contextual factors that are outside of teachers' influence: the quality of the "match" between the teacher and the school (OECD, 2012[6]) can be important as well as the match between teachers' and students' socio-demographic characteristics (Dee, 2005[7]; Fairlie, Hoffmann and Oreopoulos, 2014[8]; Gershenson et al., 2018[9]; Gershenson, Holt and Papageorge, 2016[10]; Lim and Meer, 2017[11]). This implies that teachers can be more or less effective depending on the environment they operate in and the students they are assigned to.

Similarly, different teaching styles and practices can be especially beneficial for some students (more than for others), and this makes it difficult to identify teaching practices that can be considered "superior" to others. Le Donné, Fraser and Bousquet (2016[12]) find that cognitive activation strategies are less strongly related to mathematics achievement in schools where a larger share of students comes from a socio-economically disadvantaged background. Caro, Lenkeit and Kyriakides (2016[13]) similarly conclude that the association between cognitive activation and performance is stronger for socio-economically advantaged students and in schools with a positive disciplinary climate. Direct, teacher-centred instruction is also believed to be superior for disadvantaged, at-risk students (Butler, 2020[14]), and student-centred instruction can, therefore, amplify socio-economic gaps in achievement (Clark, Kirschner and Sweller, 2012[15]; Kirschner, Sweller and Clark, 2006[16])

A consensus is, however, slowly growing on what constitutes "quality" or "effective" teaching (OECD, 2020[17]) thanks to a large set of studies that have tried to unpack the relationship between teaching and learning in order to identify teachers' attributes and teaching practices that are more likely to facilitate the cognitive and the socio-emotional development of students This large and growing body of literature informs the conceptual framework of surveys like the Teaching and Learning International Survey (TALIS), and as a consequence the questionnaires administered as part of the survey. Different frameworks give more or less emphasis to different aspects, and sometimes use different terminologies to refer to similar concepts. The TALIS framework emphasises a number of practices related to instructional quality that have received much attention in the literature (Ainley and Carstens, 2018[18]). Good teaching requires a well-managed classroom in which disruptions are minimised and learning time is maximised. Good teachers must be able to communicate in a clear and comprehensive way; they should help students gain a deep understanding of the subject by requiring them to evaluate, integrate and apply knowledge to solve problems; they should be able to provide effective support to students, listening to their needs, respecting their ideas, and encouraging them; they should provide constructive feedback through both formative and summative assessments. Effective teachers should also, of course, be competent professionals: they should possess and continue to develop appropriate content and pedagogical knowledge as well as affective and motivational competencies, and this knowledge should inform their teaching practices (Guerriero, 2017[19]).

This chapter draws on data from TALIS 2018. It examines how teachers' characteristics and practices that the research literature has shown to be robustly correlated with students' achievement are distributed across schools.

Given that the analysis aims at informing policies about the allocation and relocation of teachers in order to achieve more equitable outcomes for students, the distinction between teachers' characteristics and practices is particularly relevant. The former are in a sense fixed and portable assets that teachers always possess irrespective of the schools where they are employed. Practices, on the contrary, are the result of an explicit choice made by teachers who are teaching in a given context (and as such they are elicited by means of the TALIS questionnaire). Nothing ensures that they would adopt the same practices in a different school or even with different students in the same school. Indeed, it can be argued that the ability of a teacher to adapt their methods of instructions to the specific learning needs of their students is an important element of quality teaching, especially for educational systems that value inclusiveness (Brussino, 2021[20]; OECD, 2012[6]; Peterson et al., 2018[21]).

The analysis will look at inequalities in students' access to effective teachers from two different angles and using different tools. A first approach aims at assessing whether teachers with certain traits are clustered in a restricted number of schools. Clustering arises whenever similar individuals (in this case, teachers with similar characteristics) end up together (in this case, working in the same school). Clustering can be the result of teachers' behaviours (similar teachers are more likely to apply to the same school) as well as of schools' behaviour (when a school tends to only hire teachers sharing a narrow set of characteristics). This report will not be able to disentangle which of these mechanisms is at play.

Clustering will be measured by the dissimilarity index, which capture to what extent the distribution of teachers belonging to different groups depart from what would be observed if teachers were allocated across schools in a perfectly random way. The index (commonly used as a measure of segregation) is related to the proportions of teachers of either one of two groups that have to be displaced in order to achieve a perfectly even distribution, i.e. a situation where the shares of teachers of different types in each school equals the shares observed in the overall population. It ranges from 0 to 1, where 0 represents the situation of perfect evenness and 1 the situation of maximum unevenness, in which all teachers of one type are concentrated in a single school.[1] More details on the dissimilarity index are contained in Box 2.1.

Analysis based on the dissimilarity index addresses issues related to *equality* in a broad sense: by being only focused on characteristics of *teachers*, it disregards characteristics of the *students* as well as the fact that students themselves sort across schools on the basis of their personal characteristics (OECD, 2019[22]). The dissimilarity index tells us the likelihood that teachers with certain characteristics are clustered together in the same school. This information can be useful for policy makers to better understand the process of teachers' sorting in their country.

Randomly assigning teachers to schools, however, might not help in addressing concerns related to *equity*. In equitable education systems, the achievement of educational potential does not depend on personal and social circumstances, including factors such as gender, ethnic origin, immigrant status, special education needs and giftedness (OECD, 2017[23]; OECD, 2012[6]). To achieve this goal, it may be necessary to devote more resources (including more effective teachers) to disadvantaged students who, for different reasons, do not compete on an equal footing with their more advantaged peers. This is the distinction between horizontal and vertical equity (OECD, 2017[24]), where the former considers the overall fair provision of resources to each part of the school system (providing similar resources to the alike) and the latter involves providing disadvantaged groups of students or schools with additional resources based on their needs.

Issues related to equity are more directly assessed by looking at whether "better" teachers (a shortcut here for teachers' characteristics and teaching practices robustly associated with higher student proficiency) are more or less likely to teach disadvantaged students. Unfortunately, TALIS contains little information about the characteristics of all the students that each surveyed teacher teaches to. The only information that can be exploited is at the school level. In particular, the chapter will focus on three different variables that capture important features of the population of students served by the teachers.[2]

The first variable is the socio-economic composition of the student body. Schools where more than 30% of students come from socio-economically disadvantaged homes[3] are classified as "disadvantaged schools", and schools where less than 10% of the students are socio-economically disadvantaged are classified as "advantaged schools".

The second variable refers to the location of the school, distinguishing between rural and urban areas. Schools located in rural areas often cater to students with particular socio-economic profiles and may face a distinctive set of challenges (Echazarra and Radinger, 2019[25]); urban and rural schools can also differ in their ability to attract and retain teachers.

The third variable relates to school governance, distinguishing between public and private schools.[4] The public or private management of schools is an important factor in many countries in explaining the segregation of students according to their socio-economic background (OECD, 2019[22]). It is important, however, to acknowledge that the relevance of urban-rural or public-private divides can vary across countries and national contexts. (The share of teachers and schools by each school type are presented in Tables A.B.2 and A.B.3 in Annex C.)

The implicit assumption underlying this analysis is that all students in a given school are equally "exposed" to all the teachers in the school (or, equivalently, that students are randomly sorted into classes). The validity of this assumption varies across countries depending on the particular institutional arrangements governing class formation, the assignment of teachers to classes, and whether such arrangements change from grade to grade.

Box 2.1. Measuring teachers' allocation across schools: the dissimilarity index

The dissimilarity index is useful for assessing whether students have equal access to teachers with certain characteristics because it measures to what extent the distribution of teachers across schools deviate from what would have been observed if they were distributed randomly across schools (OECD, 2019[22]).

The dissimilarity index is particularly useful when looking at teachers' characteristics that can be meaningfully expressed as dichotomous variables. Once the population of teachers has been partitioned in two mutually exclusive groups (e.g. teachers with a master's degree and teachers without a master's degree), the dissimilarity index corresponds to the average proportions of teachers from both groups (e.g. those who possess and those who do not possess a master's degree) that would need to be reallocated in order to obtain a distribution of teachers from both groups across all schools that is identical to the overall distribution within the country, maintaining equal school size (OECD, 2019[22]). Moreover, it may also be interpreted as the proportion of one or the other group that has to be reallocated in order to achieve a distribution of teachers from these groups that mirrors the overall population, assuming that school size can be adjusted. The dissimilarity index ranges from 0 (i.e. the allocation of teachers in schools perfectly resembles the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school). A high dissimilarity index means that the distribution of teachers with a certain characteristic is very different from what would be observed if they were distributed randomly across schools. Hence, it is an indication of teachers with a certain characteristic being highly concentrated in certain schools.

By design, the value of the dissimilarity index increases as the overall shares of both groups in the teacher population becomes more unbalanced, based on the specific teacher characteristic being analysed. In those cases, where the share of teachers with a certain characteristic in the overall teacher population is either very small or large, the value of the dissimilarity index tends to be high. In the extreme case, when there are more schools than actual teachers with a certain characteristic in a country, the value of the dissimilarity index is larger than zero even if these teachers are randomly allocated across schools (OECD, 2019[22]). Thus, the comparability of the dissimilarity index across countries warrants caution, especially when the group of teachers with certain characteristic that is analysed varies considerably across countries.

In addition, the value of the dissimilarity index is also affected by the size of the units (i.e. schools) across which the distribution of individuals are analysed. Notably, if the units' sizes are small, then the dissimilarity index tends to overestimate the level of deviations from randomness (also known as small-unit bias) (Carrington and Troske, 1997[26]; D'Haultfœuille and Rathelot, 2017[27]; D'Haultfœuille, Girard and Rathelot, 2021[28]). For example, the smaller the schools in terms of the number of teachers teaching in the school, the more likely it is to observe a deviation from the random allocation of teachers with certain characteristic.

Note: For additional information on the dissimilarity index, see Annex B.

It is also important to acknowledge that the analysis is purely descriptive and focuses on a single characteristic of the school (be it student composition, location, or type of governance). Schools can differ in many potentially important ways that explain the differences in the characteristics and practices of teachers working in a certain school. For instance, rural schools tend to be smaller than urban schools. School size can be, in itself, a factor driving teachers' application decisions. The results of the analysis should not then be interpreted in a causal sense (as school characteristics determining the prevalence of certain teachers), and should be complemented with country-specific information about the specific structure of the education system.

After having investigated the allocation of teachers' characteristics and practices, the chapter will look at the prevalence of effective learning environments in different types of schools. Schools are effective learning environments when all stakeholders – students, parents, teachers, principals – co-operate and complement each other, and interact in a way that delivers learning outcomes superior to what would be expected by simply looking at the sum of each individuals' contributions. The analysis in this chapter will not cover all elements that contribute to creating effective learning environments. Rather, it will narrowly focus on two indicators that capture the quality of the leadership exerted by principals: this extends the analysis conducted on the allocation of teachers across different schools to principals. Two indicators will be examined: the degree to which principals engage in instructional leadership and whether all teachers have access to mentoring. These are arguably two indicators over which principals have significant margin of manoeuvre, and they can, therefore, be considered as reasonable proxies of principals' quality (intended as principals' ability to create effective learning environments).

Finally, the focus of the analysis will shift to how teachers' characteristics and practices are related and how this relationship varies with school characteristics. This will be particularly informative from a policy perspective. While the first part of the chapter analyses different dimensions of teaching quality in isolation, in practice, teaching is performed by people who possess a bundle of these characteristics and choose to adopt certain practices. Policies trying to achieve better outcomes for students by modifying the allocation of teachers must necessarily take these interrelationships into account.

The allocation and sorting of effective teachers across schools

Experienced teachers

The finding that more experienced teachers are on average more effective in raising the performance of their students is probably one of the most robust and most widely accepted in the literature (Papay and Kraft, 2015[29]). Studies generally find that effectiveness increases steeply in the first few years of teachers' careers, and remain constant afterwards. Evidence is now emerging, however, that teachers can keep improving much later in their career (Wiswall, 2013[30]), and that whether or not they do so might well depend on whether they have the opportunity to work in a supportive professional environment (Kraft and Papay, 2014[31]).

In the following analysis, teachers with more than ten years of professional experience are labelled as "experienced teachers" as opposed to "less experienced teachers" who have ten years or less of teaching experience. For most countries, the share of experienced teachers in the overall teacher population ranges between 50 and 70% (Figure 2.2).

Portugal, Saudi Arabia and Turkey are the three TALIS countries where experienced teachers are more likely to be concentrated in a small number of schools (Figure 2.1) with values of the dissimilarity index larger than 0.5 (as compared to an OECD average of about 0.3). In the case of Portugal, though, this result must be taken with care in light of the fact that more than 90% of teachers in Portugal are classified as "experienced". In such cases, looking at allocation across schools may not be particularly meaningful as, inevitably, most students will have access to some experienced teachers (see the footnote of Figure 2.1).

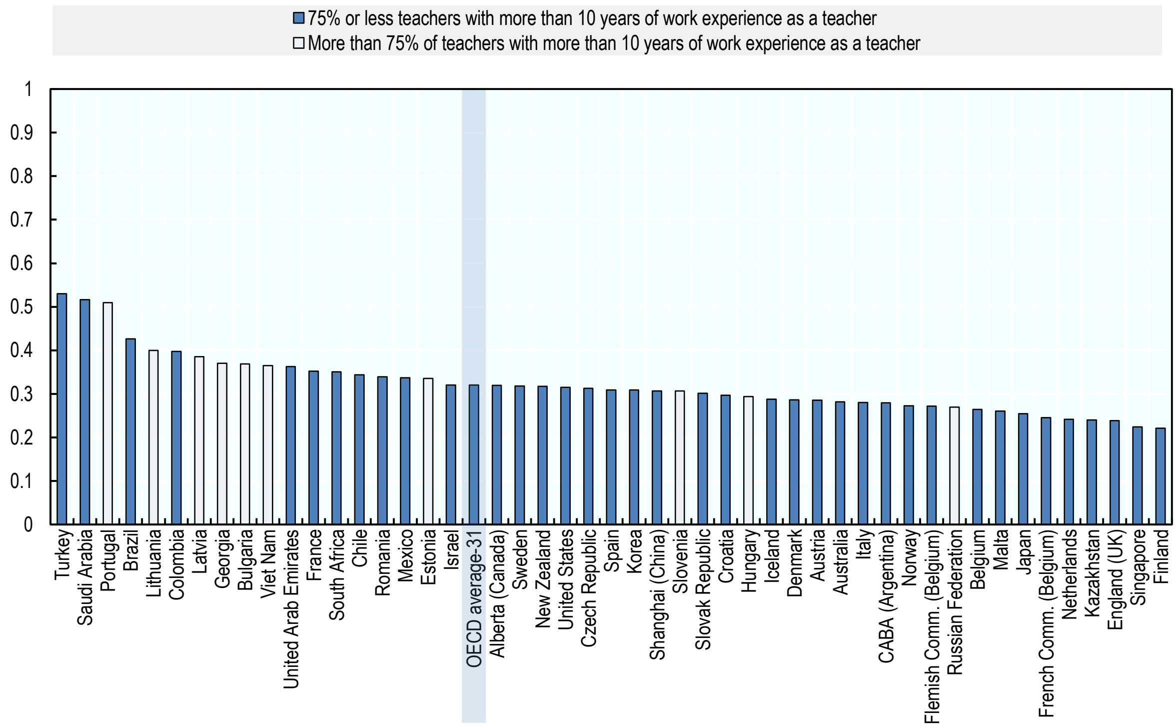
The dissimilarity index for experienced teachers shows much lower values than the OECD average in England (United Kingdom), Finland and Singapore, signalling that the share of experienced teachers in a given school is likely to be similar to the share in the overall population in these countries (Figure 2.1).

An alternative way to look at this issue, which overcomes difficulties related to the interpretation and cross-country comparability of the dissimilarity index, relies on examining the proportion of the overall variance in teacher experience that lies between schools (as opposed to the variance within schools). This method works well in the case of continuous variables such as teachers' experience but is not without drawbacks. In particular, this indicator is more sensitive, for instance, to differences between schools where teachers have on average 20 years of experience and schools where teachers have on average 30 years of experience. But if teaching effectiveness increases with experience only up to 10 years, the difference between the two sample schools would, in fact, not matter.

Nevertheless, it is reassuring that the two indicators deliver similar results. While the proportion of variance in teachers' experience that lies between schools is 8.2% on average across OECD countries participating in TALIS, this indicator is as high as 37% in Saudi Arabia, 33% in Turkey and 20% or more in Colombia and Portugal, which are the same countries with high values of the dissimilarity index (Table 2.4).

Figure 2.1. Allocation of experienced teachers

Dissimilarity index for lower secondary teachers with more than ten years of work experience as a teacher



Note: The dissimilarity index measures if the allocation of teachers with a given characteristic in a country's schools resembles the overall teacher population of the country and it ranges from 0 (i.e. the allocation of teachers in schools perfectly resembles the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school). By design, the value of the dissimilarity index is high when the share of teachers with a certain characteristic in the overall teacher population is either very small or large. Thus, cross-country comparability warrants caution.

Countries and territories are ranked in descending order of the dissimilarity index for teachers with more than ten years of work experience as a teacher.

Source: OECD, TALIS 2018 Database, Table 2.3.

StatLink https://stat.link/svdr4b

In many of the countries participating in TALIS, experienced teachers are more likely to work in schools with a low concentration of socio-economically disadvantaged students (less than 10% of the student body) than in schools where disadvantaged students constitutes more than 30% of the student body (Figure 2.2). The differences between these two types of schools in the share of experienced teachers are particularly large in Australia, Estonia, the Flemish Community of Belgium and Saudi Arabia, where they range between 13 and 18 percentage points. In a few other countries, however, experienced teachers are more likely to work in schools with a large share of disadvantaged students. This is, in particular, the case of Colombia (with a difference of 19 percentage points), Shanghai (China) (14 percentage points) and Israel (12 percentage points).

Figure 2.2. Experienced teachers, by school characteristics

Results based on responses of lower secondary teachers and principals

A	City - rural area
B	Private - public schools
C	High - low concentration of disadvantaged students[1]

+	Positive difference
-	Negative difference
	Difference is not significant
	Missing values

Difference in the share of teachers with more than ten years of work experience as a teacher, by school characteristics (percentage-point)

	A	B	C
Portugal		-22	11
Lithuania			
Latvia			
Georgia		-21	
Bulgaria			
Estonia			-14
Slovenia			
Hungary			-6
Viet Nam		-26	-11
Russian Federation			
Czech Republic		-12	
Spain	14		
Slovak Republic		-11	
Shanghai (China)		-9	14
Romania	28		-8
France			-12
Italy		-21	
Colombia		-29	19
Brazil		-12	8
Finland			
Sweden		-17	-6
OECD average-31		-4	-3
Netherlands			
Denmark			
Korea		13	
Flemish Comm. (Belgium)		9	-13
Kazakhstan			
Iceland			
New Zealand		15	
Japan			
Austria	-14		
Mexico	14	-11	
Belgium		5	-10
Croatia			
CABA (Argentina)			
Israel			12
South Africa			
United States	-10		-10
Norway	-11		
Australia*		14	-13
United Arab Emirates	-20	-27	7
French Comm. (Belgium)			
England (UK)			-7
Alberta (Canada)			-13
Malta		-15	
Saudi Arabia	25		-18
Chile	14		
Singapore		26	
Turkey	34	-9	-12
Edu. systems with a pos. diff.	6	6	6
Edu. systems with no diff.	27	16	16
Edu. systems with a neg. diff.	4	14	14

* For this country, estimates for sub-groups and estimated differences between sub-groups need to be interpreted with great care. See Annex A for more information.

1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal to 10% of students from socio-economically disadvantaged homes.

Countries and territories are ranked in descending order of the share of teachers with more than ten years of work experience as a teacher.

Source: OECD, TALIS 2018 Database, Table 2.3.

StatLink https://stat.link/axq5kv

In many countries, the differences between private and public schools are also particularly large. More often than not, experienced teachers are over-represented in public schools (Figure 2.2). Colombia, the United Arab Emirates and Viet Nam are the countries where this phenomenon is more evident. Australia, Korea, New Zealand and Singapore are among the few countries, on the other hand, where experienced teachers are more likely to work in private schools.

In most countries there are no significant differences between schools located in rural settings (towns with, at most, 3 000 inhabitants) and schools located in urban areas (cities with more than 100 000 inhabitants) (Figure 2.2). Where differences along these dimensions exist, they tend to be quite large in both directions. In Turkey, for instance, the differences in the share of experienced teachers between urban and rural schools is as high as 34 percentage points, meaning that experienced teachers are largely concentrated in urban schools. Divides of similar magnitudes are observed in Romania and Saudi Arabia. Austria, Norway, the United Arab Emirates and the United States are examples of countries in which experienced teachers are over-represented in rural schools.

Content of formal education

A unique feature of TALIS is the amount of detailed information it contains about the content of initial teacher education programmes (OECD, 2019[32]). This allows this report to go beyond studies that have traditionally focused on the simple effect of teachers' licensing. As the content and requirements of teachers' education vary greatly both across countries and within countries over time, it is particularly important to have more precise information on the kind of initial education received by teachers.

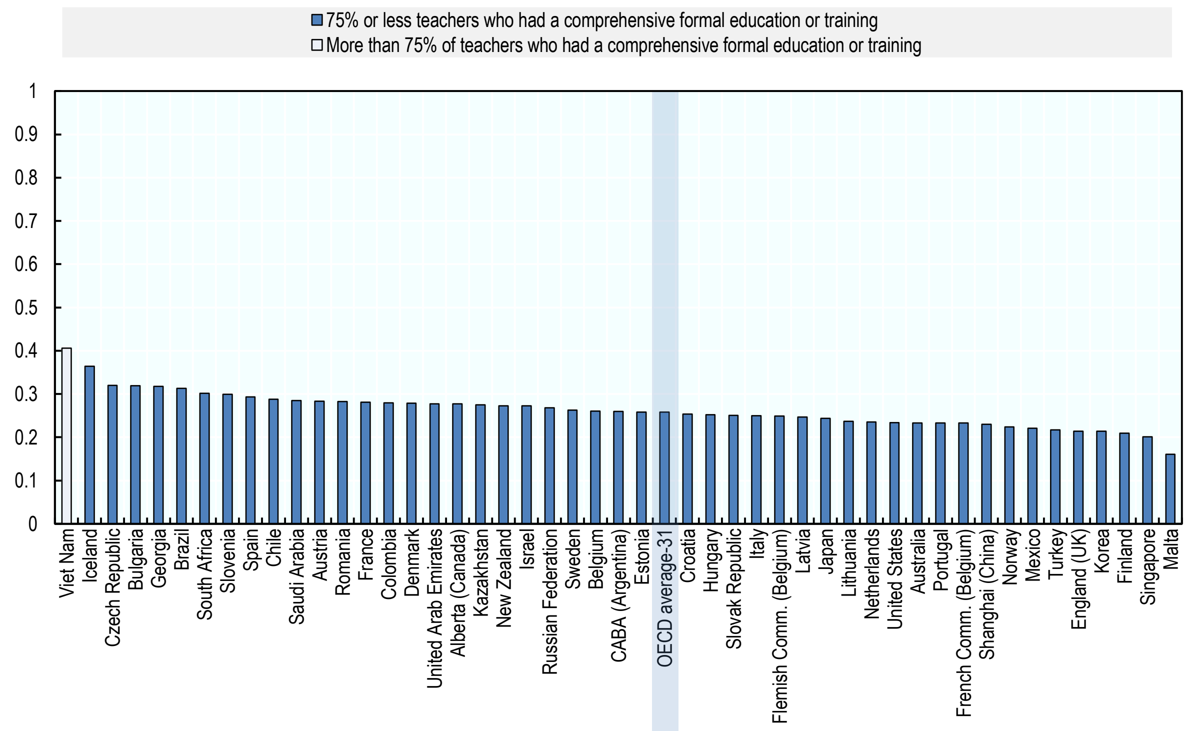
Arguably, the type and quality of teacher education are important determinants of teacher knowledge, which in turn is significantly related to student achievement (Baumert et al., 2010[33]; Hill, Rowan and Ball, 2005[34]). For the purpose of the analysis presented in this report, it is useful to combine the rich information on initial teacher education collected in TALIS in a simple binary indicator of "comprehensive education", which identifies teachers whose initial formal education and training covered a broad set of topics, including content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting and classroom management.

On average across OECD countries participating in TALIS, about 40% of teachers received a comprehensive initial education (Figure 2.4). For most countries, this share ranges between 30 and 60%. There is a much smaller proportion of teachers with comprehensive initial education in the Czech Republic (17%) and Spain (17%) whereas they constitute a large majority in the United Arab Emirates (73%) and Viet Nam (86%).

Variations across countries in the dissimilarity index (which captures the degree to which teachers with a comprehensive initial education are unevenly distributed across schools) are limited (Figure 2.3). The dissimilarity index varies in the vast majority of countries between 0.2 and 0.3. It is relatively small in Malta (0.16) and relatively large in Iceland and Viet Nam (above 0.35). The result for Viet Nam should, however, be interpreted with care, given the very large share of teachers in the country with comprehensive initial education.

Figure 2.3. Allocation of comprehensively trained teachers

Dissimilarity index for lower secondary teachers who had a comprehensive formal education or training



Notes: "Comprehensively trained teachers" refers to teachers for whom content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting and classroom management were included in their formal education or training.

The dissimilarity index measures if the allocation of teachers with a given characteristic in a country's schools resembles the overall teacher population of the country and it ranges from 0 (i.e. the allocation of teachers in schools perfectly resembles the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school). By design, the value of the dissimilarity index is high when the share of teachers with a certain characteristic in the overall teacher population is either very small or large. Thus, cross-country comparability warrants caution.

Countries and territories are ranked in descending order of the dissimilarity index for teachers who had a comprehensive formal education or training.

Source: OECD, TALIS 2018 Database, Table 2.5.

StatLink https://stat.link/eof71q

Similarly, in most countries there are no large differences between different types of schools in the share of teachers who received a comprehensive education (Figure 2.4). Differences between private and public schools are slightly more pronounced in a number of countries. Public schools generally are more likely to employ comprehensively educated teachers, especially in countries such as Japan, Kazakhstan, Sweden and Viet Nam. In Belgium (including its Flemish Community) and Denmark, on the other hand, these teachers are more likely to work in private schools.

In only a handful of countries are there differences in the share of comprehensively educated teachers between rural and urban schools (Figure 2.4). Where these differences exist, they are in favour of rural schools: this is the case for Brazil, Croatia and Romania, in particular.

In seven countries, comprehensively educated teachers are more likely to work in schools with a high concentration of socio-economically disadvantaged students (Figure 2.4). This is the case in particular of

Ciudad Autónoma de Buenos Aires (hereafter CABA [Argentina]), Israel and Italy. These teachers are overly represented in advantaged schools in Belgium (including its Flemish Community) and Spain.

Figure 2.4. Comprehensively trained teachers, by school characteristics

Results based on responses of lower secondary teachers and principals

A	City - rural area
B	Private - public schools
C	High - low concentration of disadvantaged students[1]

+	Positive difference
-	Negative difference
	Difference is not significant
	Missing values

	Difference in the share of teachers who had a comprehensive[2] formal education or training, by school characteristics (percentage-point)		
	A	B	C
Viet Nam		-20	
United Arab Emirates		4	
Shanghai (China)			7
Singapore			
United States			
South Africa			
England (UK)			7
Romania	-13		
Colombia			
Alberta (Canada)			
New Zealand		-5	
Turkey			
Kazakhstan	-7	-12	
Mexico			
Saudi Arabia			
Russian Federation			
Chile			
Brazil	-13		
Australia*			
Korea			
Malta			
Hungary	-9		
Israel			12
Flemish Comm. (Belgium)		10	-8
CABA (Argentina)		-8	17
Sweden		-11	
Japan		-19	
Latvia			
Estonia			
Denmark		9	
OECD average-31		-2	
Belgium		9	-7
Slovak Republic			
Finland			
Croatia	-11		
Italy		-10	12
Norway			
French Comm. (Belgium)			
Lithuania			
Portugal			
Bulgaria			
Netherlands			
Georgia			
Iceland			
Austria			7
France		-7	5
Slovenia			
Spain			-5
Czech Republic			
Edu. systems with a pos. diff.	0	4	7
Edu. systems with no diff.	32	24	26
Edu. systems with a neg. diff.	5	8	3

* For this country, estimates for sub-groups and estimated differences between sub-groups need to be interpreted with great care. See Annex A for more information.

1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal to 10% of students from socio-economically disadvantaged homes.

2. Teachers for whom content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting and classroom management were included in their formal education or training.

Countries and territories are ranked in descending order of the share of teachers who had a comprehensive formal education or training.

Source: OECD, TALIS 2018 Database, Table 2.5.

StatLink https://stat.link/uetsch

Self-efficacy

Self-efficacy captures individuals' perceptions of their capabilities of performing a task. Such perceptions can influence actual behaviours and, thus, performance. A vast literature in education has showed robust positive association between self-efficacy and performance. This is true for students, where self-efficacy correlates with academic performance (Honicke and Broadbent, 2016[35]), as well as for teachers, with higher self-efficacy being associated with higher quality instructional practices (Holzberger, Philipp and Kunter, 2013[36]) and better student outcomes (Caprara et al., 2006[37]; Woolfolk Hoy and Davis, 2006[38]).

Contrary to self-confidence, self-efficacy is conceptually related to specific tasks. This is why TALIS elicits teachers' self-efficacy in a number of dimensions: classroom management, instruction, and student engagement. An overall self-efficacy scale can be computed as an average of these different dimensions (OECD, 2019[39]).

Within this report, overall self-efficacy is considered as a "fixed" characteristic of teachers such as years of experience or the content of initial education. It must be acknowledged, though, that self-efficacy is definitely more prone to change over time. It is often conceptualised as being context-specific (Tschannen-Moran and Hoy, 2001[40]), in which case relocating teachers to different schools is no guarantee that the teacher would keep the same level of self-efficacy in the new school.

Teachers with high self-efficacy are identified as those in the top quarter of the overall self-efficacy scale in their own country. Doing so has two great advantages for analysis. First, the analysis does not suffer from possible lack of measurement invariance,[5] making the results more comparable across countries. Second, the analysis based on the dissimilarity index is more robust because by construction the share of high-self-efficacy teachers is not negligible (being equal to 25%) and is the same in all countries.

Figure 2.5 shows that there is a fair degree of heterogeneity across countries in the extent to which teachers with high self-efficacy are allocated across schools. The largest degree of clustering is observed in Alberta (Canada), Belgium, New Zealand and South Africa, where the dissimilarity index is between 0.37 and 0.40.

In spite of the imbalances signalled by the dissimilarity index, there are actually few differences between schools of different types in terms of the share of teachers with high self-efficacy (Figure 2.5). In Finland and Singapore, private schools are more likely to employ teachers with high self-efficacy while the opposite is true in CABA (Argentina) and Norway. A more consistent divide is between urban and rural schools: in Australia, Estonia, Finland, France, Italy, Lithuania and Sweden, high self-efficacy teachers are significantly more likely to work in urban schools rather than in rural schools. The only country where the opposite is true is Chile.

In only three countries are differences between advantaged and disadvantaged schools observed (Figure 2.5). Teachers with high self-efficacy are more likely to work in disadvantaged schools in South Africa, and more likely to work in advantaged schools in Belgium and Spain.

Figure 2.5. Allocation of teachers with high self-efficacy

Results based on responses of lower secondary teachers and principals

A	City - rural area
B	Private - public schools
C	High - low concentration of disadvantaged students[1]

+	Positive difference
-	Negative difference
	Difference is not significant
	Missing values

	Difference in the share of teachers in the top quarter according to overall self-efficacy, by school characteristics (percentage-point)		
	A	B	C
South Africa			10
Alberta (Canada)			
New Zealand			
Belgium		6	-5
Viet Nam			
Bulgaria			
Iceland			
Georgia			
Brazil			
Chile	-8	-8	
United States			
Denmark			
CABA (Argentina)		-13	
Sweden	14		
Kazakhstan		-9	
Saudi Arabia			
Netherlands			
Latvia			
Slovak Republic			
Hungary			
United Arab Emirates	4	6	
OECD average-31	3	1	
Romania			
Norway		-12	
Lithuania	10		
England (UK)			
Israel			
Mexico		5	
Czech Republic			
Japan			
Colombia			
Croatia			
French Comm. (Belgium)			
Spain		6	-7
Estonia	10		
Shanghai (China)			
Korea			
Italy	8		
Finland	8	13	
Austria			
Slovenia			
Australia*	13		
France	7	5	
Singapore		19	
Portugal			
Turkey			
Flemish Comm. (Belgium)			
Malta			
Edu. systems with a pos. diff.	8	7	1
Edu. systems with no diff.	27	25	33
Edu. systems with a neg. diff.	1	4	2

* For this country, estimates for sub-groups and estimated differences between sub-groups need to be interpreted with great care. See Annex A for more information.

Note: The dissimilarity index measures if the allocation of teachers with a given characteristic in a country's schools resembles the overall teacher population of the country and it ranges from 0 (i.e. the allocation of teachers in schools perfectly resembles the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school).

1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal 10% of students from socio-economically disadvantaged homes.

Countries and territories are ranked in descending order of the dissimilarity index for teachers in the top quarter according to overall self-efficacy.

Source: OECD, TALIS 2018 Database, Table 2.6.

StatLink https://stat.link/y3cto5

Fairness in students' exposure to effective teaching practices

TALIS 2018 collected information on a number of instructional practices that the research literature has identified as being important elements of teaching quality. This chapter will focus in particular on three practices for which the empirical literature has been able to establish the most robust relationship with students' achievement: cognitive activation, clarity of instruction, and time spent on actual teaching.

In order to mitigate concerns about social desirability bias, rather than using an agreement scale (i.e. asking teachers how much they agree with a given activity being important or desirable), TALIS relies on frequency scales, asking teachers how often they perform certain activities that characterise a given practice. Combining answers to different items allows the construction of a scale that measures the degree to which teachers adopt a given practice. This is how the scales of cognitive activation and clarity of instruction were constructed (OECD, 2019[39]).

Time spent on actual teaching is computed by directly asking teachers about the share of class time they typically spend on actual teaching as opposed to administrative tasks and keeping order in the classroom.

For all three practices, the analysis focuses on teachers in the top quarter of the national distribution of the measure. As was the case for self-efficacy, this maximises the extent to which the dissimilarity index can be compared across countries.

Cognitive activation

Cognitive activation consists of instructional activities that require students to evaluate, integrate and apply knowledge within the context of problem solving (Ainley and Carstens, 2018[18]; Lipowsky et al., 2009[41]). The use of cognitive activation has been shown to be related to higher student achievement. This is the case for mathematics in the Programme for International Student Assessment (PISA) (Le Donné, Fraser and Bousquet, 2016[12]) although the relationship seems to be less strong in schools with a high share of disadvantaged students. On the other hand, using TIMSS data, Bellens et al. (2019[42]) conclude that instructional quality (of which cognitive activation is an element) has similar positive effects on the achievement of all students. Cognitive activation strategies have also been found to moderate the positive effect of pedagogical content knowledge on students' achievement (Baumert et al., 2010[33]).

Among TALIS participants, South Africa is the country where teachers relying more on cognitive activation strategies are most unevenly distributed across schools (dissimilarity index: 0.41), followed by Brazil, Chile, New Zealand, Saudi Arabia and Viet Nam (dissimilarity index: 0.37). The allocation is much more even in France, Malta, Portugal and Singapore (i.e. dissimilarity index between 0.19 and 0.24) (Figure 2.6).

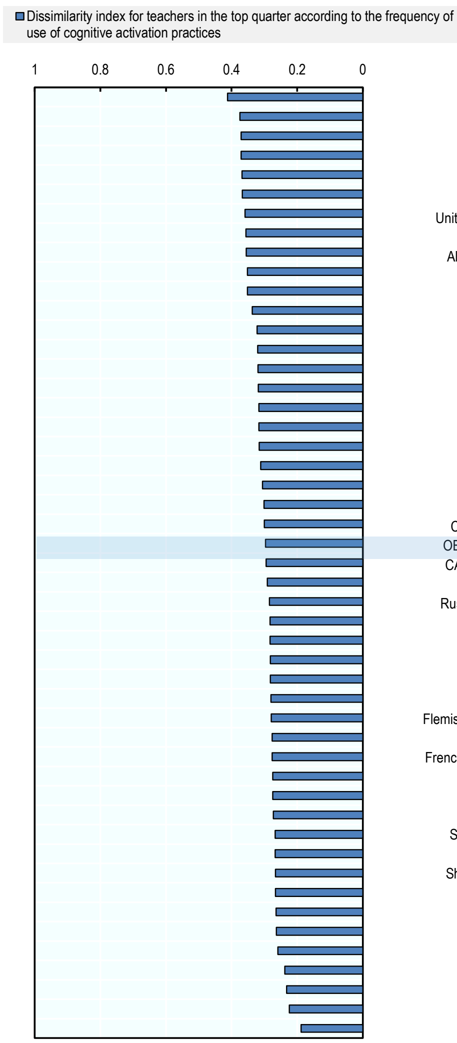
However, such imbalances do not necessarily mean there is uneven student access to teachers who effectively use cognitive activation strategies. In most countries, the differences between advantaged and disadvantaged schools in this regard are not statistically significant. Yet, there are four countries – Austria, Israel, Lithuania and Portugal – where the share of teachers who frequently rely on cognitive activation is higher in socio-economically advantaged schools than in disadvantaged schools (Figure 2.6).

Figure 2.6. Allocation of teachers who often use cognitive activation practices

Results based on responses of lower secondary teachers and principals

A	City - rural area
B	Private - public schools
C	High - low concentration of disadvantaged students[1]

+	Positive difference
-	Negative difference
	Difference is not significant
	Missing values



	Difference in the share of teachers in the top quarter according to the frequency of use of cognitive activation practices, by school characteristics (percentage-point)		
	A	B	C
South Africa			
Viet Nam			
Saudi Arabia			
Chile		-10	
Brazil			
New Zealand			
United Arab Emirates	4	8	
Georgia			
Alberta (Canada)			
United States			
Estonia	9		
Romania			
Netherlands			
Iceland			
Sweden			
Australia*	10		
Bulgaria			
Israel			-8
England (UK)			
Latvia			
Colombia			
Kazakhstan		-5	
Czech Republic		11	
OECD average-31	2	2	-2
CABA (Argentina)			
Hungary			
Russian Federation			
Lithuania	5		-8
Belgium			
Turkey	-7		
Italy			
Finland		21	
Flemish Comm. (Belgium)			
Spain			
French Comm. (Belgium)			
Austria			-11
Mexico			
Slovenia			
Slovak Republic			
Croatia			
Shanghai (China)		8	
Korea			
Norway	8		
Denmark			
Japan			
Singapore		14	
Portugal		6	-6
France			
Malta			
Edu. systems with a pos. diff.	5	6	0
Edu. systems with no diff.	31	28	32
Edu. systems with a neg. diff.	1	2	4

* For this country, estimates for sub-groups and estimated differences between sub-groups need to be interpreted with great care. See Annex A for more information.

Note: The dissimilarity index measures if the allocation of teachers with a given characteristic in a country's schools resembles the overall teacher population of the country and it ranges from 0 (i.e. the allocation of teachers in schools perfectly resembles the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school).

1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal to 10% of students from socio-economically disadvantaged homes.

Countries and territories are ranked in descending order of the dissimilarity index for teachers in the top quarter according to the frequency of use of cognitive activation practices.

Source: OECD, TALIS 2018 Database, Table 2.8.

StatLink https://stat.link/7zexjs

More frequently, divides emerge between public and private schools. Cognitive activation practices are more common in private schools in six TALIS participating countries and territories, and the differences are largest in Finland (21 percentage points), Singapore (14 percentage points) and the Czech Republic (11 percentage points). Chile and Kazakhstan are the only two countries where the divide is in favour of public schools.

In only six countries are some differences between urban and rural schools observed. In Australia, Estonia, Lithuania, Norway and the United Arab Emirates, cognitive activation practices are more likely to be used in urban schools while in Turkey the opposite is true.

Clarity of instruction

Clarity of instruction is conceptualised in TALIS as the ability to set clear and comprehensive instruction and learning goals, to connect new and old topics, and to provide students with a summary of the lesson at its end (Ainley and Carstens, 2018[18]). Various studies have shown how this practice is related to positive student outcomes, including learning motivation, achievement and satisfaction (Hines, Cruickshank and Kennedy, 1985[43]; Seidel, Rimmele and Prenzel, 2005[44]). In TIMSS, students that reported higher scores for their teachers on this dimension tended to have better performance in mathematics and science (Mullis et al., 2020[45]). In Blazar (2015[46]), (lack of) clarity is part of a broader construct of mathematical error and imprecisions, which is found to be negatively correlated to students' achievement.

As was the case for cognitive activation practices, there is evidence of an uneven allocation of teachers who frequently adopt clarity of instruction techniques across schools but there is less evidence of teachers' sorting in schools with particular characteristics (Figure 2.7). The largest departure from a random allocation of teachers occurs in Alberta (Canada) and Chile, with dissimilarity index values above 0.4. Smaller values (still above 0.2) are recorded in France, the French Community of Belgium and Portugal.

In 12 countries and territories, teachers who rely most on clarity of instructions tend to be concentrated in public schools (Figure 2.7). The difference with respect to private schools is largest in Italy (15 percentage points), Australia (13 percentage points) and the United States (13 percentage points). Finland and Singapore are the only countries where clarity of instruction is more frequently adopted in private schools.

Fewer differences emerge according to school location. Teachers tend to adopt clarity of instruction more frequently in urban schools in seven countries, in particular in Alberta (Canada), Finland and the United States. Yet, in Hungary, Romania and South Africa, this practice is more common in rural than urban schools.

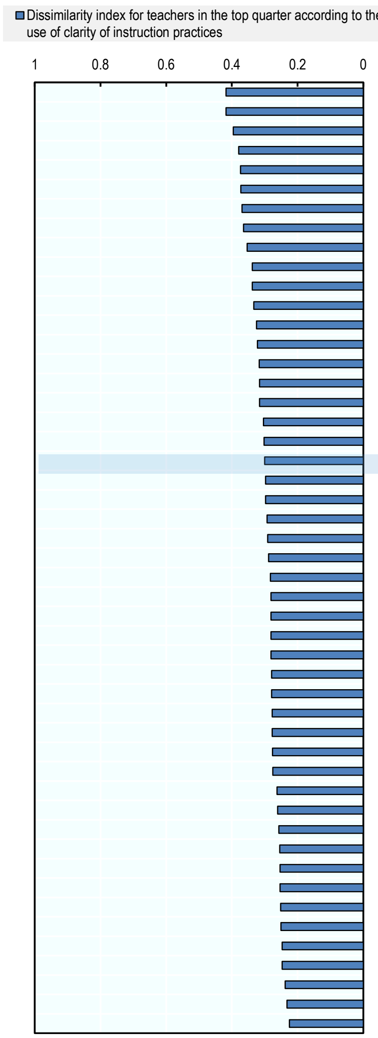
Differences according to the socio-economic composition of the student body are present in only two countries (Australia and Chile); in both cases, they are to the benefit of disadvantaged schools, whose teachers are more likely to often use clarity of instruction techniques.

Figure 2.7. Allocation of teachers who often rely on clarity of instruction

Results based on responses of lower secondary teachers and principals

A	City - rural area
B	Private - public schools
C	High - low concentration of disadvantaged students[1]

+	Positive difference
-	Negative difference
	Difference is not significant
	Missing values



	Difference in the share of teachers in the top quarter according to the frequency of use of clarity of instruction practices, by school characteristics (percentage-point)		
	A	B	C
Alberta (Canada)	18		
Chile		-10	10
Netherlands			
Saudi Arabia			
United States	15	-13	
Viet Nam			
Australia*		-13	13
Iceland			
Georgia			
Sweden	8		
Estonia	11		
South Africa	-12		
Denmark			
Bulgaria			
Brazil			
Russian Federation			
Slovak Republic		-7	
CABA (Argentina)		-9	
United Arab Emirates			
OECD average-31	4	-3	2
Romania	-8		
Hungary	-7	-5	
Italy		-15	
New Zealand		-6	
Turkey			
Latvia			
Mexico			
Spain			
Colombia			
Flemish Comm. (Belgium)			
Japan		-8	
Kazakhstan			
Croatia			
Israel			
Czech Republic			
England (UK)			
Finland	12	13	
Norway			
Malta			
Lithuania	5		
Korea		-5	
Belgium		-4	
Shanghai (China)			
Singapore		15	
Slovenia	9		
Austria		-4	
French Comm. (Belgium)			
France			
Portugal			
Edu. systems with a pos. diff.	7	2	2
Edu. systems with no diff.	27	22	34
Edu. systems with a neg. diff.	3	12	0

* For this country, estimates for sub-groups and estimated differences between sub-groups need to be interpreted with great care. See Annex A for more information.

Note: The dissimilarity index measures if the allocation of teachers with a given characteristic in a country's schools resembles the overall teacher population of the country and it ranges from 0 (i.e. the allocation of teachers in schools perfectly resembles the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school).

1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal to 10% of students from socio-economically disadvantaged homes.

Countries and territories are ranked in descending order of the dissimilarity index for teachers in the top quarter according to the frequency of use of clarity of instruction practices.

Source: OECD, TALIS 2018 Database, Table 2.10.

StatLink https://stat.link/1tco3y

Time spent on actual teaching

More instruction time during class translates into higher student achievement (Carroll, 1963[47]; Muijs et al., 2014[48]; Schmidt, Zoido and Cogan, 2014[49]). This has been shown to hold across different settings, using different data and different empirical strategies. In PISA, differences in weekly instructional time can account for cross-country differences in students' achievement (Lavy, 2015[50]). The strength of this relationship varies across countries and depends on the classroom environment (Rivkin and Schiman, 2015[51]). In Germany, shortening the length of the school year had a negative effect on educational achievement, increasing grade repetition and resulting in fewer students attending higher secondary school tracks (Pischke, 2007[52]). In Denmark, a large-scale randomised trial showed that increases in instruction time lead to higher student learning (Andersen, Humlum and Nandrup, 2016[53]).

The literature on teaching quality has stressed the ability of teachers to maximise instruction time as one important component of classroom management (Ainley and Carstens, 2018[18]; Kane et al., 2010[54]; Stronge et al., 2007[55]).

In TALIS, classroom management is captured by a question on the disciplinary climate observed in the classroom. A different question, though, gets closer to identifying the instruction time to which students are exposed: it asks teachers how class time is allocated between different tasks such as administrative tasks, keeping order and actual teaching. Data from the TALIS-PISA link study show that students of teachers who spend a higher share of class time on actual teaching perform better in the PISA assessment (OECD, 2021[56]).

Data from TALIS 2018 show that teachers who are in the top quarter of the national distribution in terms of the share of class time they spend on actual teaching are far from being equally represented across schools. On average across OECD countries that participated in TALIS, the dissimilarity index equals 0.33 (Figure 2.8). In Georgia, South Africa and Viet Nam, the distribution is particularly uneven, with the index exceeding 0.45. In Lithuania, Portugal and Shanghai (China) the value of the index is smallest, although still above 0.25.

Large and systematic differences are observed between different types of schools in the majority of countries. Teachers that spend more class time on actual teaching are much more likely to work in advantaged schools as well as private schools (Figure 2.8). As for the former, the divides are particularly large (above 20 percentage points) in Alberta (Canada), Denmark, and New Zealand. Shanghai (China) is the only territory in which disadvantaged schools are more likely to employ teachers in the top quarter of the distribution of the share of class time spent teaching. Differences between private and public schools are largest in Singapore (32 percentage points), Kazakhstan (17 percentage points), Australia (16 percentage points), Denmark (15 percentage points) and New Zealand (15 percentage points). The only countries in which public schools are more likely to employ teachers who spend a high share of class time in actual teaching than private schools are Italy and Japan.

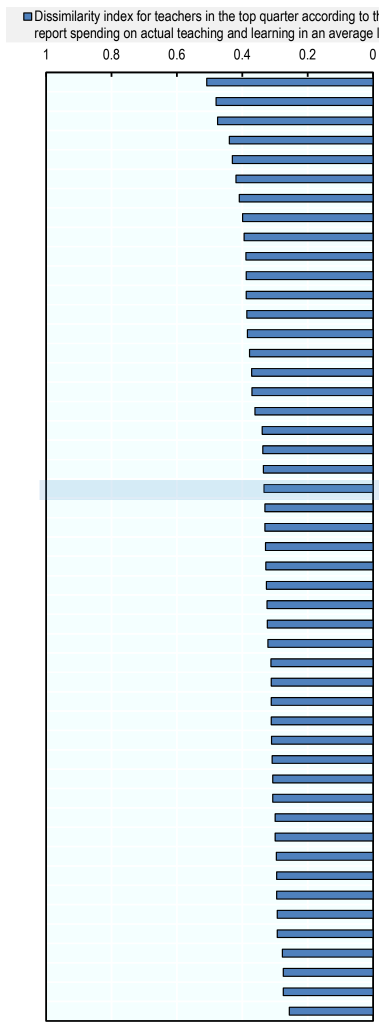
Differences according to school location are less common. In nine countries, rural schools are more likely to employ teachers who spend a large share of class time in actual teaching, with differences particularly large (20 percentage points or above) in Colombia and Spain. Differences are in favour of urban schools in Australia, Hungary, Kazakhstan and Lithuania.

Figure 2.8. Allocation of teachers who spend a high share of class time on actual teaching

Results based on responses of lower secondary teachers and principals

A	City - rural area
B	Private - public schools
C	High - low concentration of disadvantaged students[1]

+	Positive difference
-	Negative difference
	Difference is not significant
	Missing values



	Difference in the share of teachers in the top quarter according to the average proportion of time teachers report spending on actual teaching and learning in an average lesson, by school characteristics (percentage-point)		
	A	B	C
Viet Nam			
Georgia			
South Africa			
Chile			
Alberta (Canada)			-23
Bulgaria			-12
Iceland			
Brazil		11	
United States			-17
Colombia	-22		
New Zealand		15	-21
Kazakhstan	11	17	
Singapore		32	
Australia*	16	16	-19
Saudi Arabia			-9
Denmark	-9	15	-21
CABA (Argentina)			
United Arab Emirates		6	
Sweden			-10
England (UK)			-10
France		10	-14
OECD average-31	-6	5	-9
Spain	-20	10	-9
Turkey	-10		-7
Romania			
Norway	-9		
Austria	-9	10	-11
Japan		-7	-10
Belgium		10	-9
French Comm. (Belgium)		9	
Finland	-12	13	
Mexico	-9		
Netherlands			
Croatia			
Czech Republic			
Israel			
Latvia			
Estonia			
Hungary	6		-5
Korea			
Slovenia	-11		
Italy		-11	
Russian Federation			
Malta			
Flemish Comm. (Belgium)		6	-12
Slovak Republic			
Portugal		11	-7
Shanghai (China)			7
Lithuania	5		-7
Edu. systems with a pos. diff.	4	15	1
Edu. systems with no diff.	24	19	16
Edu. systems with a neg. diff.	9	2	19

* For this country, estimates for sub-groups and estimated differences between sub-groups need to be interpreted with great care. See Annex A for more information.

Note: The dissimilarity index measures if the allocation of teachers with a given characteristic in a country's schools resembles the overall teacher population of the country and it ranges from 0 (i.e. the allocation of teachers in schools perfectly resembles the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school).

1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal to 10% of students from socio-economically disadvantaged homes.

Countries and territories are ranked in descending order of the dissimilarity index for teachers in the top quarter according to the proportion of time spent on actual teaching and learning in an average lesson.

Source: OECD, TALIS 2018 Database, Table 2.12.

StatLink https://stat.link/4coi96

Effective learning environments and the importance of school leaders

While teachers are undoubtedly the most important school-related factor that contributes to students' achievement, many other things can help improve learning, often by facilitating, improving and complementing the work of teachers. Much research has emphasised the importance of creating "effective learning environments" (Ainley and Carstens, 2018[18]). In such environments, the overall results are often larger than what the sum of individual components would deliver elsewhere. Many different actors can play a role in helping create such environments, including students themselves, parents, and teachers, but school principals play a crucial role in this respect. One could argue that a school principal's most important job is to create an effective learning environment for teachers and students to work together. Principals are, therefore, ultimately important for student outcomes, although the relationship is likely to be indirect, operating through teachers or an overall school climate that is more conducive to learning (Hallinger, 2011[57]). Recent literature in economics has also highlighted the importance of managerial skills for principals (Bloom et al., 2015[58]; Di Liberto, Schivardi and Sulis, 2015[59]).

TALIS 2018 surveyed both teachers and principals, collecting a wide range of indicators describing the institutional environment and conditions under which teachers operate. This includes, among others, practices related to teachers' professional development and information about the characteristics of the principals and the type of tasks they are more engaged with. As the broad goal of this chapter is to investigate to what extent students have equal and fair access to effective learning environments in their specific school, the following analysis will focus on two indicators that can vary across schools and that can be plausibly shaped and influenced by school principals: principals engaging in instructional leadership and the availability of mentoring programmes for teachers in the school.

The survey was designed in such a way that these indicators are only available at the school level. As there is only one principal in any given school, it is not possible to examine their distribution across schools by means of indicators such as the dissimilarity index. In the following sections, only differences between different types of schools will be reported.

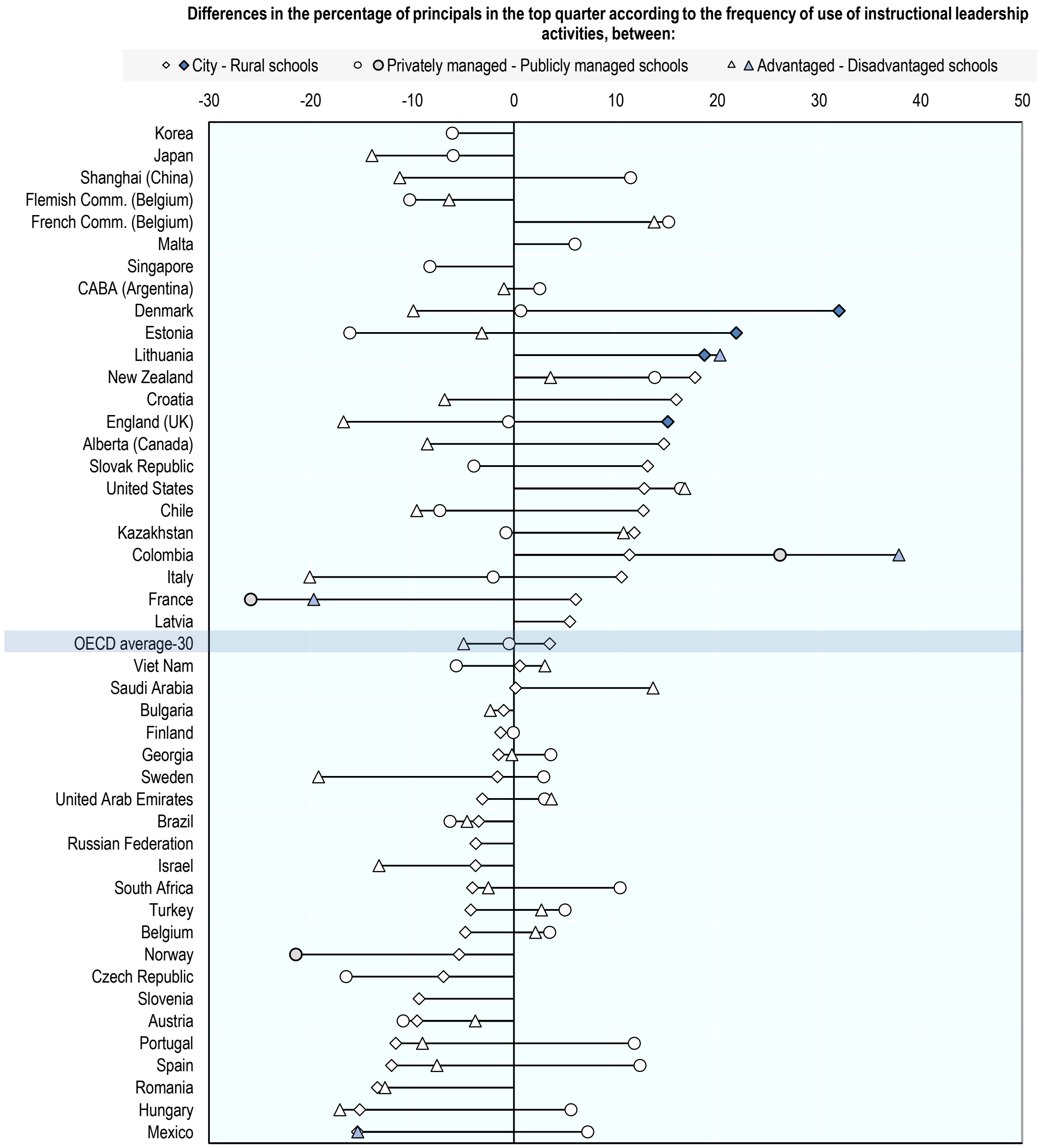
Instructional leadership

Instructional leadership refers to the actions that a principal takes to promote growth in students' learning (Flath, 1989[60]). Concrete actions that principals can take to improve the quality of instructions and, therefore, students' learning include managing the curriculum, attending to teachers' professional development needs and creating a culture of collaboration. In TALIS, instructional leadership is measured by asking principals how much they support teachers co-operating to develop new practices; and how much they ensure that teachers feel responsible for their students' outcomes and take responsibility for improving their teaching skills. Indeed, previous findings from TALIS show a positive association between instructional leadership and collaboration among teachers (OECD, 2016[61]), which is in turn beneficial for students' learning (Goddard et al., 2015[62]).

The degree to which principals are actually able to implement these actions can vary significantly from country to country as the boundaries of school autonomy are often regulated at the national level. For this reason, the analysis will focus on principals that are in the top quarter of the national distribution of the index of instructional leadership, i.e. principals who show a higher tendency to adopt instructional leadership actions when facing a similar set of institutional rules.

Figure 2.9. Principals' instructional leadership, by school characteristics

Results based on responses of lower secondary principals



Notes: Advantaged schools refer to schools with up to 10% of students from socio-economically disadvantaged homes. Disadvantaged schools refer to schools with more than 30% of students from socio-economically disadvantaged homes.
A publicly managed school is a school whose principal reported that it is managed by a public education authority, government agency, municipality, or governing board appointed by government or elected by public franchise. A privately managed school is a school whose principal reported that it is managed by a non-governmental organisation (e.g. a church, trade union, business or other private institution).
Statistically significant differences are shown in darker tones.
Countries and territories are ranked in descending order of the percentage-point difference between city and rural schools.
Source: OECD, TALIS 2018 Database, Table 2.14.

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Very few statistically significant differences between different types of school emerge when looking at the likelihood of employing a principal who scores in the top quarter of the national distribution in terms of instructional leadership (Figure 2.9). This is in part due to the large margin of error associated with estimated differences: the number of schools surveyed in TALIS is relatively limited, rarely exceeding 200. In Colombia and Lithuania this calibre of principals are more likely to work in socio-economically advantaged schools but the opposite is true in France and in Mexico. The difference between private and public schools is positive in Colombia but negative in France and Norway (meaning that principals who score high on the instructional leadership scale are more likely to work in public schools in these two countries). Slightly more consistent results emerge when looking at geographical factors, with urban schools more likely to have principals that adopt an instructional leadership style in Denmark, Estonia, England (United Kingdom) and Lithuania.

Teachers' access to mentoring

Mentoring and induction programmes are an important element of teachers' continuing professional development. They can be especially important for novice teachers, who are generally less effective than more experienced ones.

The literature on the effects of mentoring programmes is relatively new (Ingersoll and Strong, 2011[63]; Jackson, Rockoff and Staiger, 2014[64]). More recent and rigorous studies generally find positive effects on students' achievement (Glazerman et al., 2010[65]; Rockoff, 2008[66]). Interestingly, practices that can be considered similar in spirit to mentoring programmes and that are not explicitly targeted to novice teachers such as protocols for teachers' peer observations have been found to be beneficial not only for students of the observed teacher but also for students of the observee (Burgess, Rawal and Taylor, 2021[67]).

Initiatives that favour teachers' collaboration and mutual help in professional development can be relatively simple, and principals can put them in place. Despite this, they are still relatively uncommon in countries that participated in TALIS 2018 (OECD, 2019[32]).

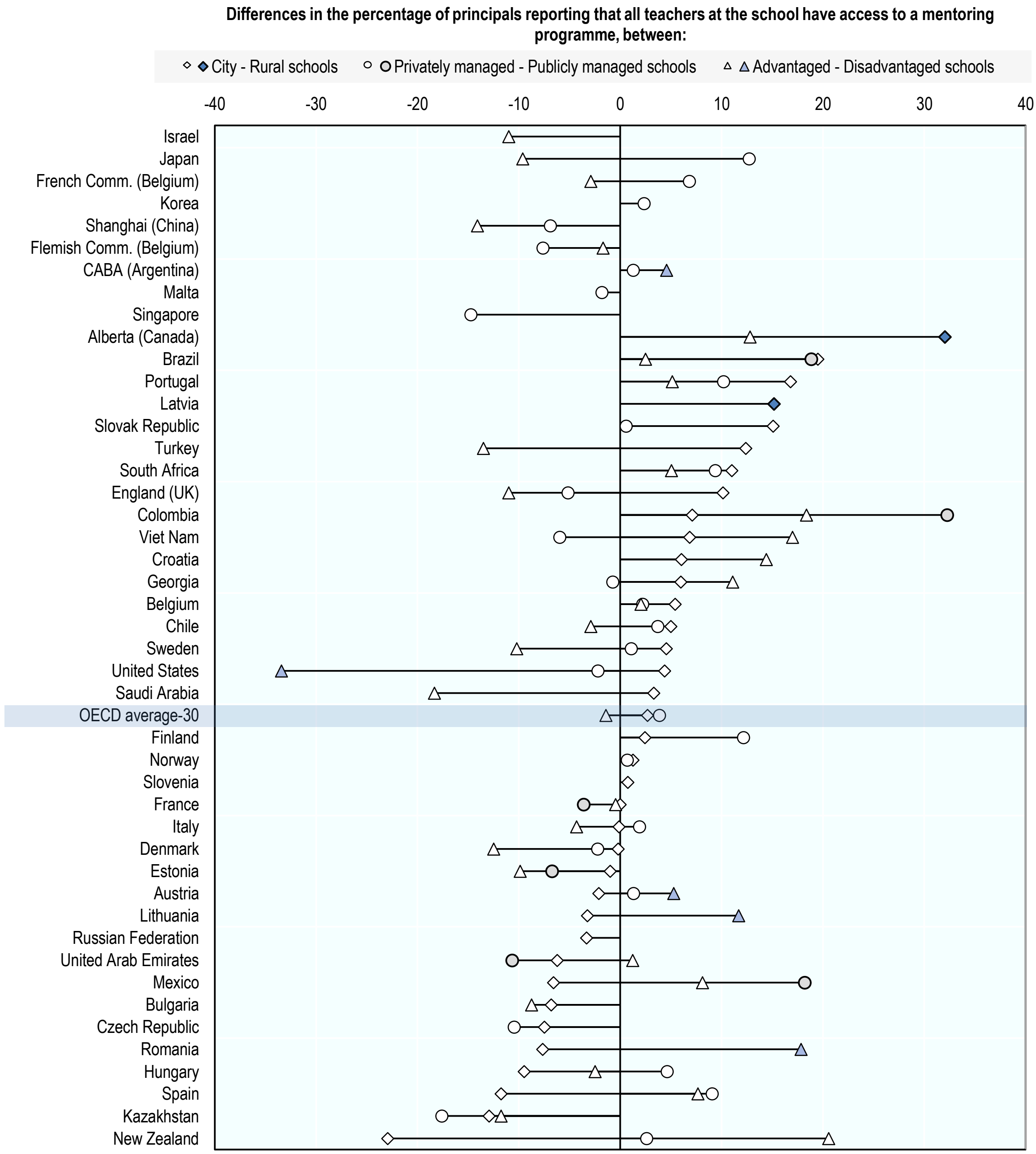
Except for a few countries, teachers' access to mentoring programmes is similar across advantaged and disadvantaged schools. However, in Austria, CABA (Argentina), Lithuania and Romania, the share of principals who reported that all teachers in their school had access to a mentoring programme is higher in socio-economically advantaged schools (Figure 2.10). The United States is a notable exception as mentoring programmes are more prevalent in schools with more disadvantaged students.

In most countries, mentoring is likely to be equally present in urban and rural schools. Exceptions are Alberta (Canada) and Latvia, where access to mentoring programmes is higher in urban schools (Figure 2.10).

Evidence is mixed on the difference in teachers' access to mentoring in public and private schools (Figure 2.10). In Brazil, Colombia and Mexico, there is more likely to be mentoring for all teachers in private schools but the opposite holds true in Estonia, France and the United Arab Emirates.

Figure 2.10. Teachers' access to mentoring, by school characteristics

Results based on responses of lower secondary principals



Notes: Advantaged schools refer to schools with up to 10% of students from socio-economically disadvantaged homes. Disadvantaged schools refer to schools with more than 30% of students from socio-economically disadvantaged homes.

A publicly managed school is a school whose principal reported that it is managed by a public education authority, government agency, municipality, or governing board appointed by government or elected by public franchise. A privately managed school is a school whose principal reported that it is managed by a non-governmental organisation (e.g. a church, trade union, business or other private institution).

Statistically significant differences are shown in darker tones.

Countries and territories are ranked in descending order of the percentage-point difference between city and rural schools.

Source: OECD, TALIS 2018 Database, Table 2.15.

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The relationship between teacher characteristics, school characteristics, and teaching practices

So far the analysis has focused on a single teacher characteristic or teaching practice at a time. However, teachers have a wide range of characteristics and practices they can employ. In order to inform teacher allocation policies, it is important to understand how these different characteristics and practices are related to each other.

As it is impossible to analyse all the dimensions involved, the focus will be on the relationship between two important teaching practices (cognitive activation and class time spent on actual teaching) and teachers' characteristics. This will be informative about possible changes in teaching practices in a school when teachers with certain characteristics have been relocated to that school.

The analysis will also investigate whether the relationship between teachers' characteristics and teaching practices varies depending on schools' characteristics. This tells us about the extent to which different teachers will adapt or change their practices depending on the environment they operate in.

The analysis relies on multilevel regression models. These models can estimate the relationship between a given practice and teachers' characteristics, and how that varies with school characteristics, while at the same time taking into account the nested structure of the data (i.e. the fact that teachers are clustered within particular schools). Schools and teachers, therefore, form the two levels of the model. Adding an interaction term between teachers' characteristics (such as teachers' years of experience) and school characteristics (such as the share of disadvantaged students) is informative on how the strength of the relationship between a given practice and a given characteristic (captured by the coefficient associated to teachers' characteristics) changes when looking only at schools with those given characteristics (schools with a high share of disadvantaged students in all the analyses presented in this section). A negative sign for the coefficient associated to the interaction terms signals, for instance, that the strength of the relationship between teaching practice and teachers' characteristics is weaker in disadvantaged schools (and the other way around for a positive coefficient).

Multilevel models not only deliver estimates of regression coefficient (how much the odds of teachers adopting a certain practices varies with teachers' characteristics) they also provide estimates of how much the overall variance in practices varies between and within schools. Looking at how the between-school variance changes after adding teachers' characteristics to the model is informative about the possible outcomes of teachers' reallocation as it tells how much difference between schools one can expect after accounting for the fact that different schools employ teachers with different characteristics.

Table 2.1 summarises the relationship between the use of cognitive activation and the three teacher characteristics analysed previously. It also shows how the relationship varies depending on the socio-economic background of the students they teach. In essentially all countries that participated in TALIS, teachers with a higher sense of self-efficacy are more likely to adopt cognitive activation practices. On average across OECD countries, however, this relationship is weaker in disadvantaged schools. Chile and Korea are two exceptions in the sense that the likelihood that teachers with high self-efficacy adopt cognitive activation strategies is actually higher in disadvantaged schools.

Almost equally robust is the positive relationship between cognitive activation practices and having received a comprehensive initial teacher education. The relationship is positive in most countries, and negative only in the French Community of Belgium (Table 2.1). In a few countries (Czech Republic, Israel, Malta, Slovenia, Spain) the strength of this relationship is even stronger in disadvantaged schools.

Table 2.1. Relationship between the use of cognitive activation practices and teacher characteristics, by concentration of students from socio-economically disadvantaged homes

Results of linear multilevel regression based on responses of lower secondary teachers and principals

	Use of cognitive activation practices[1,2] and…					
	Teachers' years of work experience as teachers[3]		Teachers for whom content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting and classroom management were included in their formal education or training[4]		Teachers' self-efficacy[5]	
	coef.	x disadv schools[6]	coef.	x disadv schools	coef.	x disadv schools
Alberta (Canada)	-0.3				0.4	
Australia	-0.2				0.4	
Austria					0.2	
Belgium	-0.1				0.2	
Flemish Comm. (Belgium)	-0.1		0.3		0.3	
French Comm. (Belgium)			-0.3		0.3	
Brazil					0.3	
Bulgaria	0.2				0.4	
CABA (Argentina)	-0.3				0.4	
Chile					0.3	0.1
Colombia					0.7	-0.2
Croatia					0.3	
Czech Republic		0.2	0.2	1.0	0.2	-0.2
Denmark	-0.1				0.4	
England (UK)	-0.1		1.0	-0.8	0.4	
Estonia			0.2		0.3	-0.2
Finland					0.3	
France			0.5		0.3	
Georgia					0.4	
Hungary	0.2		0.2		0.4	
Iceland		1.3			0.2	-1.1
Israel		0.6		0.8	0.4	
Italy			0.3		0.4	
Japan	-0.3		0.3		0.3	
Kazakhstan	0.1		0.7		0.5	
Korea	-0.4		0.4		0.4	0.4
Latvia			0.5		0.5	
Lithuania	0.1		0.4		0.2	
Malta	-0.2	-0.5		6.4	0.3	-2.7
Mexico			0.3		0.3	
Netherlands	0.3	-0.7			0.4	
New Zealand		0.3			0.3	
Norway			0.2		0.4	-0.2
Portugal					0.4	
Romania					0.3	
Russian Federation	0.4	-0.8	0.8			
Saudi Arabia			1.0		0.5	
Shanghai (China)			0.8		0.3	-0.2
Singapore			0.3		0.5	-0.2
Slovak Republic	0.1		0.4		0.3	
Slovenia				1.1	0.3	

	Use of cognitive activation practices[1,2] and...					
	Teachers' years of work experience as teachers[3]		Teachers for whom content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting and classroom management were included in their formal education or training[4]		Teachers' self-efficacy[5]	
	coef.	x disadv schools[6]	coef.	x disadv schools	coef.	x disadv schools
South Africa			0.7		0.4	
Spain		-0.3	0.3	0.6	0.4	
Sweden					0.2	
Turkey			0.7		0.4	
United Arab Emirates			0.3		0.5	
United States			0.6		0.2	
Viet Nam					0.3	
OECD average-31	0.0		0.2		0.3	-0.1

Edu. systems with a pos. association	7	4	24	5	47	2
Edu. systems with no association	31	40	23	41	0	37
Edu. systems with a neg. association	10	4	1	1	0	8

+ Positive difference
- Negative difference
Difference is not significant
Missing values

1. The index of cognitive activation practices measures the frequency with which a teacher uses cognitive activation practices in the classroom. Standardised scale scores with a standard deviation of 2.0 and a mean of 10, where the value 10 corresponds to the mid-point of the scale. These data are reported by teachers and refer to a randomly chosen class they currently teach from their weekly timetable.
2. Controlling for other school characteristics, including school location, school type (i.e. in terms of public/private management) and student composition of schools according to students' socio-economic and language background as well as their characteristics in terms of special needs. For Israel and the Netherlands, school type (i.e. in terms of public/private management) is excluded due to data availability.
3. Number of years (standardised).
4. Dummy variable: reference category refers to teachers for whom either content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting or classroom management were not included in their formal education or training.
5. The index of self-efficacy measures teacher self-efficacy in classroom management, instruction and student engagement. Standardised scale scores with a standard deviation of 2.0 and a mean of 10, where the value 10 corresponds to the mid-point of the scale.
6. Interaction term with dummy variable: the reference category is less than or equal to 10%. "Socio-economically disadvantaged homes" refers to homes lacking the basic necessities or advantages of life, such as adequate housing, nutrition or medical care.
Source: OECD, TALIS 2018 Database, Table 2.16.

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More mixed results emerge when looking at the relationship between teachers' years of professional experience and the use of cognitive activation. On average across the OECD countries that participated in TALIS 2018 the relationship is negative, meaning that more experienced teachers are less likely to rely on cognitive activation (Table 2.1). However, the relationship is actually positive in many countries like Bulgaria, Hungary, Kazakhstan, Lithuania, the Netherlands, the Russian Federation and the Slovak Republic. In the majority of countries, the strength of this relationship does not seem to depend on the share of disadvantaged students in the school.

Do differences in teachers' characteristics account for the variation between schools in terms of the use of cognitive activation practices? An answer to this question is contained in Table 2.19. The table tells us first that the share of variation in the use of cognitive activation that lies between schools is small on average across OECD countries (2.7%), although there are some differences across countries. The share of variance between schools is not identical to the dissimilarity index but it does measure similar concepts. It is, therefore, not surprising that the country with the highest dissimilarity index value (South Africa) is also the country with the highest share of between-school variance at 20%. Similarly, the share of between-school variance is among the lowest in France (0.2%) and Slovenia (0.6%), which are also countries with a low level of the dissimilarity index (Tables 2.8 and 2.19).

Balancing the composition of teachers across schools would greatly reduce between-school variation in the use of cognitive activation. In models that control for teacher characteristics, variation between schools (as captured by the between-schools standard deviation) drops on average across OECD countries by 21% compared to an empty model that does not include those variables (Table 2.19). With very few exceptions, the decline is consistent in most of the countries that participated in TALIS.

The relationships between the share of class time spent on actual teaching and teachers' characteristics are summarised in Table 2.2. A strong and consistently positive relationship between time spent on teaching and teachers' experience and sense of self-efficacy emerges in almost all the countries participating in TALIS.

The strength of the relationship with self-efficacy appears stronger in more disadvantaged schools on average across OECD countries and especially in some countries like Estonia, Hungary, Latvia, Malta and the Slovak Republic (Table 2.2). This is less the case for teachers' experience: if anything, there is evidence that the relationship between experience and time spent teaching is actually weaker in more disadvantaged schools in a few countries.

Having received a comprehensive initial education does not appear, on the other hand, to be robustly related to the amount of time spent on actual teaching.

Differences between schools in the share of class time spent on actual teaching are larger than differences in the use of cognitive activation: the share of variance between schools is on average 8% across OECD countries and exceeds 15% in Australia, Brazil, Bulgaria, Georgia, and the United States – these are all countries that also have a dissimilarity index level that is higher than the average (Tables 2.12 and 2.27).

Controlling for teachers' characteristics, variation between schools would decrease, but not by a large amount: on average 7% across OECD countries (Table 2.27). The reduction would be highest (above 14%) in Australia, Belgium, Croatia, England (United Kingdom), Latvia and Mexico. However, there are a few countries (Alberta (Canada), Italy and Portugal) that would observe an increase in between-school variance following a relocation of teachers according to those characteristics. This means that, under the current allocation in these countries, teacher characteristics act as a counterbalance to school characteristics. This reduces the difference between schools in the average share of class time teachers spend on actual teaching.

Table 2.2. Relationship between time spent on actual teaching and teacher characteristics, by concentration of students from socio-economically disadvantaged homes

Results of linear multilevel regression based on responses of lower secondary teachers and principals

	Time spent on actual teaching[1,2] and…					
	Teachers' years of work experience as teachers[3]		Teachers for whom content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting and classroom management were included in their formal education or training[4]		Teachers' self-efficacy[5]	
	coef.	x disadv schools[6]	coef.	x disadv schools	coef.	x disadv schools
Alberta (Canada)	0.1					
Australia	0.2				0.1	
Austria					0.1	
Belgium	0.2				0.1	
Flemish Comm. (Belgium)	0.2				0.1	
French Comm. (Belgium)	0.1				0.1	
Brazil	0.1		0.2		0.1	
Bulgaria	0.1	0.2			0.1	
CABA (Argentina)	0.1			0.4	0.1	
Chile	0.2	-0.2				
Colombia	0.1					
Croatia	0.1				0.1	
Czech Republic	0.2	-0.1			0.1	
Denmark	0.1				0.1	
England (UK)	0.1				0.1	
Estonia	0.2			0.2		0.1
Finland	0.1					
France	0.1				0.1	
Georgia	0.1			-0.2		
Hungary	0.1				0.1	0.1
Iceland	0.3	-0.8			0.1	
Israel			0.2		0.0	
Italy	0.2	0.2			0.1	
Japan	0.2					
Kazakhstan	0.2					
Korea	0.2				0.0	
Latvia	0.3	-0.4			0.1	0.2
Lithuania	0.1				0.1	
Malta	0.3	-0.5		0.4		0.5
Mexico						
Netherlands	0.1				0.1	
New Zealand	0.2	-0.2				
Norway	0.2				0.1	
Portugal	0.1			0.2	0.1	
Romania	0.1				0.0	
Russian Federation	0.2		0.1	-1.5		
Saudi Arabia						
Shanghai (China)	0.2			-0.4	0.0	
Singapore	0.1				0.0	

	Time spent on actual teaching[1,2] and…					
	Teachers' years of work experience as teachers[3]		Teachers for whom content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting and classroom management were included in their formal education or training[4]		Teachers' self-efficacy[5]	
	coef.	x disadv schools[6]	coef.	x disadv schools	coef.	x disadv schools
Slovak Republic	0.2				0.0	0.1
Slovenia	0.2				0.1	
South Africa						
Spain	0.1				0.1	
Sweden	0.1				0.1	
Turkey					0.1	
United Arab Emirates	0.1				0.1	
United States			-0.3			
Viet Nam						
OECD average-31	0.1				0.1	0.0
Edu. systems with a pos. association	40	2	3	4	32	5
Edu. systems with no association	8	40	44	40	15	42
Edu. systems with a neg. association	0	6	1	3	0	0

+ Positive difference
- Negative difference
Difference is not significant
Missing values

1. These data are reported by teachers and refer to a randomly chosen class they currently teach from their weekly timetable. The variable is standardised.
2. Controlling for other school characteristics, including school location, school type (i.e. in terms of public/private management) and student composition of schools according to students' socio-economic and language background as well as their characteristics in terms of special needs. For Israel and the Netherlands, school type (i.e. in terms of public/private management) is excluded due to data availability.
3. Number of years (standardised).
4. Dummy variable: reference category refers to teachers for whom either content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting or classroom management were not included in their formal education or training.
5. The index of self-efficacy measures teacher self-efficacy in classroom management, instruction and student engagement. Standardised scale scores with a standard deviation of 2.0 and a mean of 10, where the value 10 corresponds to the mid-point of the scale.
6. Interaction term with dummy variable: the reference category is less than or equal to 10%. "Socio-economically disadvantaged homes" refers to homes lacking the basic necessities or advantages of life, such as adequate housing, nutrition or medical care.
Source: OECD, TALIS 2018 Database, Table 2.24.

StatLink https://stat.link/0uxy3v

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Notes

[1] See OECD (2019[22]) for an application of the dissimilarity index in the analysis of students' segregation across schools according to socio-economic background.

[2] Appendix tables also present analyses comparing schools according to the share of students with a foreign language background and who have special education needs. These results are not commented on in the text.

[3] "Socio-economically disadvantaged homes" refers to homes lacking the basic necessities or advantages of life such as adequate housing, nutrition or medical care; the evaluation of whether students lived in disadvantaged home is left to the evaluation of the school principal.

[4] A privately managed school is a school whose principal reported that it is managed by a non-governmental organisation (e.g. a church, trade union, business or other private institution). In some countries, the privately managed schools category includes schools that receive significant funding from the government (government-dependent private schools). A publicly managed school is a school whose principal reported that it is managed by a public education authority, government agency, municipality, or governing board appointed by the government or elected by public franchise. In the principal questionnaire, this question does not make any reference to the source of the school's funding, which is reported in the preceding question.

[5] When a latent (unobservable) construct like self-efficacy is measured by a self-report questionnaire, measurement invariance refers to the property that using the same questionnaire in different groups (such as countries) measures the same construct in the same way. Lack of measurement invariance would imply that the score in the self-efficacy scale for respondents in one country is not comparable to the scores of respondents in a different country.

3 Do students have equitable access to digital learning in school?

Digitalisation can transform education for the better. Using technology in school can improve teaching and learning, and help students acquire a broader range of skills. Yet, digital technology can also increase inequalities. Those who have limited access to information and communication technology (ICT), are not digitally literate, or unable to navigate in the digital world, are left behind. This chapter examines the distribution of teachers who are trained and feel self-efficient in and regularly use ICT across schools. It also looks at how ICT infrastructure is distributed across schools. Lastly, the chapter explores the type of schools (and students) that are more likely to benefit from the resources needed for effective digital learning.

Highlights

- The share of principals who report that the school's capacity to provide quality instruction is hindered by insufficient Internet access or the shortage or inadequacy of digital technology for teaching is greater in socio-economically disadvantaged than advantaged schools, on average across OECD countries. It is also larger in public than in private schools. And the share of schools where teaching is hampered by insufficient Internet access is higher in rural schools than those located in cities.
- Teachers who are trained in and feel capable of using information and communication technologies (ICT) and who regularly let students use ICT for projects or class work are not randomly distributed across schools. There is evidence of clustering of such teachers in all Teaching and Learning International Survey (TALIS) participants.
- The share of teachers who feel they can support student learning through the use of digital technology is larger in private than in public schools in almost a quarter of countries and territories participating in TALIS. It is also larger in socio-economically advantaged than in disadvantaged schools in seven education systems.
- The share of teachers who often let students use ICT for projects or class work is larger in private schools than in public schools in almost a quarter of countries and territories participating in TALIS.
- Across all TALIS participants, except for Malta, differences between schools in the frequency of ICT use remain significant after controlling for teacher characteristics such as teaching experience, self-efficacy, initial education and continuous professional development in the use of ICT. Differences remain significant after controlling for schools' digital infrastructure as well. Thus, reallocating teachers and improving schools' ICT infrastructure may not be sufficient in addressing inequities in students' access to digital learning in school.
- The more often teachers participate in professional collaboration, the more likely they are to regularly let students use ICT for projects or class work. Not only does digital technology encourage teachers to collaborate by providing better tools to do it but collaboration itself helps boost the use of ICT in school.

Introduction

Information and communication technologies (ICTs) have been transforming the way people live, work and learn. Digital transformation shows great potential for economies and societies to boost productivity and improve well-being. Education systems are no exception. Digitalisation can improve education delivery with the help of artificial intelligence, learning analytics, robotics, etc. (OECD, 2021[1]). Notably, the use of digital technology for teaching and learning at school can help students acquire digital skills, social-emotional skills and more standard cognitive skills such as numeracy and literacy (Bulman and Fairlie, 2016[2]).

Using ICT in the classroom can improve student outcomes in various ways. It can provide self-paced and individualised instruction; access to information and specialised materials well beyond what textbooks can offer; better tools for collaborative work; project-based and inquiry-based pedagogies; and increased students' engagement given the interactive nature of its tools (Bulman and Fairlie, 2016[2]; OECD, 2015[3]). Yet, evidence of the positive effect of ICT use at school on student outcomes is mixed (Bulman and Fairlie, 2016[2]). According to an OECD report based on Programme for International Student Assessment (PISA) 2012 data, while "… limited use of computers at school may be better than not using computers at all, using them more intensively than the current OECD average tends to be associated with significantly poorer student performance." (OECD, 2015, p. 16[3]). More recent research also shows that students who use ICT a lot or a little tend to have lower levels of reading achievement than students who have middling use of digital technology (Borgonovi and Pokropek, 2021[4]). Hence, the use of ICT at school does not automatically lead to better student outcomes. Past studies highlight that, at the classroom level, the frequency and effectiveness of digital technology use is often related to teachers' training in ICT, teachers' ability to integrate ICT into their teaching process, teachers' collaboration with other teachers as well as teachers' perceived self-efficacy and beliefs about teaching (Comi et al., 2017[5]; Ertmer et al., 2012[6]; Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017[7]; Voogt et al., 2013[8]).

Although evidence on the effect of ICT use in class on student outcomes is mixed, effective use of ICT at school can help students acquire digital skills (Bulman and Fairlie, 2016[2]). There is empirical evidence based on PISA data of a positive association between students' access to digital learning at school and students' digital skills[1] (OECD, 2021[9]; OECD, 2015[3]).

As much as technology can improve people's life, it can also increase inequalities. Those who have limited access to ICT, are not digitally literate and do not possess a certain level of cognitive skills may be unable to navigate in the digital world and hence are left behind. Inequities in access to and proficiency in ICT, in particular between socio-economically advantaged and disadvantaged students, have long been of interest to educational policy (OECD, 2015[3]). The COVID-19 pandemic exposed the challenges education systems face in addressing digital divides and drew further attention to this issue. The unprecedented disruption in the form of school closures and the subsequent switch to distant learning revealed many inadequacies from access to broadband and computers needed for online education to teachers' and students' ability to engage in online learning (OECD, 2021[10]; OECD, 2021[11]). The pandemic also showed how students from marginalised backgrounds, who have limited access to digital learning resources, lack support from their parents or are simply less motivated to learn on their own, can fall behind in digital education (Schleicher, 2020[12]).

In parallel with the steady increase in the use of ICT both at home and at school, socio-economic differences in access to computers and the Internet have decreased in most countries and territories participating in PISA (OECD, 2020[13]; OECD, 2019[14]; OECD, 2015[3]). Yet, PISA 2018 data show that portable computers and Internet access are still more widespread in socio-economically advantaged than disadvantaged schools on average across OECD countries (OECD, 2020[13]). More importantly, equal access to ICT tools does not necessarily lead to equal opportunities in leveraging digital technology. Investing in schools' ICT equipment alone is not enough to improve students' digital skills (Fraillon et al., 2019[15]). Students from socio-economically disadvantaged backgrounds may not have the necessary knowledge, skills and motivation to make the most of what technology has to offer as they tend to spend less time reading on line and obtaining practical information from the Internet (OECD, 2015[3]). Indeed, differences in ICT use are related to differences in students' digital skills (OECD, 2015[3]). A recent meta-analysis looking at the relation between students' socio-economic status and ICT literacy shows that students from more affluent families tend to perform better on tasks related to computer skills than their peers from disadvantaged socio-economic background (Scherer and Siddiq, 2019[16]). But it has to be noted that reducing inequalities in the ability to benefit from digital tools requires first and foremost that all students reach a baseline level of proficiency in basic skills such as reading and mathematics (OECD, 2015[3]; OECD, 2019[14]).

There is evidence in the literature that access to and use of ICT can have different effects on students' test scores and digital skills depending on student characteristics. Based on the results of randomised experiments conducted in India, Banerjee et al. (2007[17]) found that computer-assisted learning programmes benefit lower-performing students more than high performers. Analysing PISA 2012 data, Tan and Hew (2017[18]) conclude that access to ICT accounts for a larger share of the variance in achievement for disadvantaged students than for students from advantaged families. Similarly, there is empirical evidence suggesting that students from more disadvantaged backgrounds rely more on their teachers to learn digital skills than their peers from affluent families (Berger, 2019[19]). And access to and use of ICT at school helps students from immigrant backgrounds narrow the achievement gap (Kim, 2018[20]). Looking beyond the use of ICT, Gómez-Fernández and Mediavilla (2021[21]) find that the positive association between students' ICT interest and academic performance is greatest in the case of worst-performing students. Thus, low-performing students and those from disadvantaged backgrounds may benefit the most from being exposed to digital learning at school.

Building on TALIS 2018 data, this chapter analyses students' access to digital learning in school from two different angles:

- **Equality:** By investigating the extent to which teachers who are trained in and feel capable of using technology and those who use ICT for teaching on a regular basis are equally allocated across schools, the chapter addresses issues related to *equality*. This analysis focuses only on teacher characteristics and disregards student characteristics, as well as the fact that students themselves sort across schools based on their personal characteristics (OECD, 2019[22]). The analysis related to equality is based on the dissimilarity index (see Box 2.1 in Chapter 2 for more detail), which captures the extent to which the distribution of teachers departs from what would be observed if teachers were allocated across schools in a perfectly random way.
- **Equity (or fairness):** Providing equal resources to all students irrespective of their characteristics by randomly assigning teachers to schools may not effectively address equity concerns. Therefore, the chapter also examines the type of schools in which resources needed for effective digital learning tend to concentrate. These resources include ICT infrastructure and teachers who are trained in and feel capable of using digital technology and use ICT for instruction on a regular basis. Thus, the chapter also addresses *equity* (or *fairness)* issues in relation to digital learning (referred to as "digital divides" hereafter). In this context, the notion of *equity* (or *fairness)* refers to providing the opportunity for all students to realise their potential by removing obstacles over which individual students have no control such as unequal access to resources and practices related to digital learning. School systems that are able to weaken the link between education outcomes and individual circumstances such as students' socio-economic status, gender or immigrant background are considered equitable (OECD, 2019, p. 42[23]).

The two angles, *equality* and *equity*, are complementary. Although the analysis looking at equality in students' access to digital learning at school disregards the characteristics of students, it can still identify the teacher characteristics and practices along which teachers tend to sort across schools. The dissimilarity index can highlight overall imbalances in teacher allocation. On the other hand, analysis focusing on equity draws a more detailed picture of teacher allocation. Notably, it examines how teachers with certain characteristics and practices are distributed across different types of schools.

Box 3.1. What can TALIS say about digital divides?

Schools' ICT infrastructure

Digital learning in school requires adequate ICT infrastructure such as software, computers, laptops, smart boards and sufficient Internet access. TALIS asks school leaders' views about the extent to which the school's capacity to provide quality instruction is hindered by inadequate digital technology for teaching or Internet access.

Teacher characteristics in relation to ICT use for instruction

TALIS collects data on various teacher characteristics that can be considered proxy measures for teachers' ability to integrate ICT in their teaching in an effective manner. These include: teachers' formal education and training, continuous professional development and self-efficacy in the use of ICT for instruction.

Teaching practices in relation to ICT use for instruction

Addressing digital divides not only requires adequate digital infrastructure in schools and teachers who are trained in and feel capable of using ICT but teachers who use it in their teaching on a regular basis. TALIS asks teachers how often they let students use ICT for projects and class work.

Given that the analysis aims at informing policies about the allocation of teachers in order to achieve more equitable outcomes for students, the distinction between teacher characteristics and teaching practices is particularly relevant. Teacher characteristics are portable assets that teachers possess irrespective of the schools they work at. In contrast, teaching practices are assumed to be an explicit choice made by teachers depending on the context in which the instruction takes place. Hence, teachers may adopt different practices in a different school, or even with different students in the same school.

It is also important to note that the implicit assumption underlying the analysis is that all students in a given school have access to teachers in equal measure (or, equivalently, that students are randomly sorted into classes). The validity of this assumption varies across countries depending on the particular institutional arrangements governing class formation, the assignment of teachers to classes, and whether such arrangements change from grade to grade.

School characteristics along which equity issues are analysed

The chapter explores certain school characteristics along which equity issues in relation to students' access to digital learning at school can arise. Based on the TALIS principal questionnaire, the main school characteristics included in the analysis are: socio-economic composition of the student body (i.e. socio-economically disadvantaged schools versus advantaged schools);[2] school location (i.e. schools located in cities versus rural schools);[3] school governance (i.e. privately managed schools versus publicly managed schools).[4] Schools located in rural areas are smaller, have lower student-teacher ratios, often cater to students with particular socio-economic profiles and may face a distinctive set of challenges (Echazarra and Radinger, 2019[24]). Urban and rural schools can differ in their ability to attract and retain teachers (OECD, 2018[25]). In many countries, the type of school management (i.e. private versus public) can also be an important factor in explaining the segregation of students according to their socio-economic background (OECD, 2019[22]). Differences in terms of the student composition of schools according to language background and special education needs are also included in the tables (see Annex C) and commented on whenever certain cross-country patterns are observed. (The share of teachers and schools by each school type are presented in Tables A.B.2 and A.B.3 in Annex C.)

It is important to note, however, that the analysis is purely descriptive and focuses on a single characteristic of the school (be it student composition, location, or type of governance). Schools can differ in many potentially important ways that explain the differences in the characteristics and practices of teachers working in a certain school. For instance, rural schools tend to be smaller than urban schools. School size can be, in itself, a factor driving teachers' application decisions. The results of the analysis should not then be interpreted in a causal sense (as school characteristics determining the prevalence of certain teachers), and should be complemented with country-specific information about the specific structure of the education system.

This report draws on data collected in 2018,[5] i.e. before the outbreak of the COVID-19 pandemic. Obviously, today's reality with respect to teachers' ability to integrate ICT in teaching and learning as well as schools' digital infrastructure is different from what it was before school closures. Prior to the pandemic digital technology was one of many tools teachers could rely on. However, with school closures, ICT became the only tool at teachers' disposal to teach their students. As teachers and students had to adapt to distant learning, both the frequency of ICT use as well as teachers' capacity to use technology has increased since the start of the pandemic (OECD, 2021[11]; OECD, 2021[10]). Many education systems also enhanced teacher training in using digital tools and invested in ICT equipment as well as digital learning platforms (OECD, 2021[10]). Yet, the evidence available so far indicates that digital divides still loom. Although many countries implemented remedial measures targeting disadvantaged students such as mentoring and homework support, there is evidence from various countries that learning losses during school closures were the most severe among marginalised students (OECD, 2021[10]). Studies from England (United Kingdom), France and the Netherlands show that, due to school closures, disadvantaged students suffered greater learning losses than their peers (OECD, 2021[10]). With the pandemic putting the spotlight on inequalities in digital learning, TALIS 2018 data give insights into the extent and nature of these digital divides.

The chapter is organised as following: first, it looks at the extent to which schools with different characteristics provide effective learning environments for digital learning, including adequate ICT equipment and sufficient Internet access. Second, the chapter examines how evenly teachers who are trained in and feel capable of using ICT are distributed across schools. This section also looks at how much schools with different characteristics differ in terms of the share of teachers who are trained in and feel capable of using ICT. The last section examines the distribution of teachers who regularly use ICT for teaching across schools. It also looks at how much schools with different characteristics differ in the share of teachers who use digital technology for instruction on a regular basis. The last section concludes by exploring how much teacher characteristics and school resources in ICT infrastructure explain differences across schools in the use of ICT.

Do students have access to ICT equipment and Internet in school?

Digital learning in school requires adequate ICT infrastructure such as software, computers, laptops, smart boards and sufficient Internet access. On average across the OECD, the share of teachers who feel they can support student learning through the use of digital technology "quite a bit" or "a lot" is 7 percentage points lower in schools in which teaching is hindered by the lack of digital infrastructure (Table 3.1).[6] And the percentage of teachers with high self-efficacy in the use of ICT in the classroom is 6 percentage points lower in schools that have insufficient Internet access on average across the OECD. Moreover, the share of teachers who "frequently" or "always" let students use ICT for projects or class work is 5 percentage points lower in schools with inadequate digital infrastructure (Table 3.2). In Australia, Sweden and the United States, the difference between schools with adequate digital infrastructure and those without is 20 percentage points or more. Similarly, the percentage of teachers who often use ICT for teaching is 4 percentage points lower in schools that have insufficient Internet access on average across the OECD.

Equipping schools with ICT tools and Internet access has been an explicit goal of education policy in many OECD countries (OECD, 2019[14]). As a result, the computer-student ratio has increased between 2009 and 2018 in most countries and territories that participate in PISA. Access to the Internet has also become virtually universal in most education systems (OECD, 2020[13]). One reason why education systems invest in schools' ICT infrastructure is to compensate for disadvantaged students' limited access to ICT tools and the Internet at home (Bulman and Fairlie, 2016[2]; OECD, 2015[3]). Yet, unequal access to ICT infrastructure across schools with different characteristics remains a concern for policy makers. For instance, as revealed by PISA 2018 data, socio-economically advantaged schools tend to have larger shares of portable computers and computers connected to the Internet compared to disadvantaged schools on average across OECD countries (OECD, 2020[13]).

Differences in students' access to ICT equipment across schools

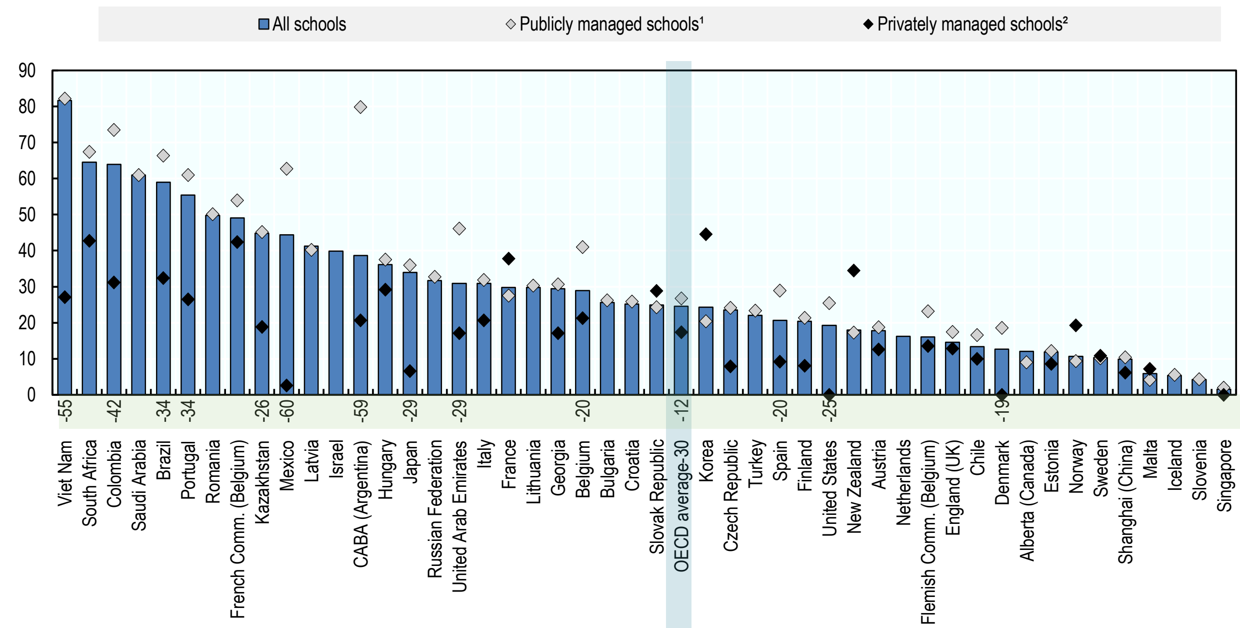
TALIS findings show that in schools with a large concentration of socio-economically disadvantaged students (i.e. more than 30%), the shortage or inadequacy of digital technology such as software, computers, laptops, and smart boards is more likely to hamper the quality of instruction. On average across OECD countries and territories, the share of principals reporting that the school's capacity to provide quality instruction was hindered by inadequate digital technology for instruction is 9 percentage points higher in socio-economically disadvantaged schools than in advantaged schools (Table 3.3). The countries and territories with the largest differences include Ciudad Autónoma de Buenos Aires (hereafter CABA [Argentina]) (69 percentage points), Mexico (50 percentage points), South Africa (41 percentage points) and Colombia (40 percentage points). There are only three countries and territories where more challenging school environments are compensated by the availability of digital technology: these are Japan, Shanghai (China) and Sweden.

Students' access to ICT equipment also depends on whether they attend publicly or privately managed schools. In more than one-third of the countries and territories with available data, the share of principals who reported that the school's capacity to provide quality instruction was hindered by inadequate digital technology for instruction is higher in public schools than in private schools (Figure 3.1). On average across the OECD, the share of principals reporting this is 12 percentage points higher in publicly managed schools than in privately managed schools. This difference exceeds 50 percentage points in CABA (Argentina), Mexico and Viet Nam. As private schools tend to be more affluent, they have more resources to maintain and improve schools' ICT equipment.

In a couple of countries participating in TALIS, rural schools are more likely to have inadequate digital infrastructure than schools located in cities. Notably, the share of principals who reported that the school's capacity to provide quality instruction was hindered by inadequate digital technology for instruction is between 21 and 31 percentage points higher in rural schools than in city schools in Bulgaria, Colombia, Kazakhstan, Russian Federation and the United Arab Emirates (Table 3.3). This may be explained by the disadvantage rural schools tend to face when it comes to school funding. Namely, funds allocated to rural schools, which are primarily based on student enrolment, usually do not reflect the higher costs of delivering education programmes and services in remote areas (OECD, 2017[26]). Moreover, in some education systems, school funding by local authorities is highly dependent on the local tax base, which tends to be lower in rural areas (Echazarra and Radinger, 2019[24]). The reverse pattern is observed in one country. In Austria, the share of principals who reported that the school's capacity to provide quality instruction was hindered by inadequate ICT equipment is 34 percentage points higher in cities than in rural areas. These results for Austria are in line with PISA 2018 data showing that shortages of material resources are perceived to be more of an issue in urban schools than in rural schools (OECD, 2020[13]).

Figure 3.1. Shortage or inadequacy of digital technology, by school type

Percentage of lower secondary principals who report that the school’s capacity to provide quality instruction is currently hindered “quite a bit” or “a lot” by shortage or inadequacy of digital technology for instruction



Note: Statistically significant differences between privately managed schools and publicly managed schools are shown next to the country/territory name (see Annex B).

1. A publicly managed school is a school whose principal reported that it is managed by a public education authority, government agency, municipality, or governing board appointed by government or elected by public franchise.

2. A privately managed school is a school whose principal reported that it is managed by a non-governmental organisation (e.g. a church, trade union, business or other private institution).

Countries and territories are ranked in descending order of the percentage of principals who report that the school’s capacity to provide quality instruction is currently hindered “quite a bit” or “a lot” by shortage or inadequacy of digital technology for instruction.

Source: OECD, TALIS 2018 Database, Table 3.3.

StatLink https://stat.link/xsly7t

Differences in students’ access to Internet across schools

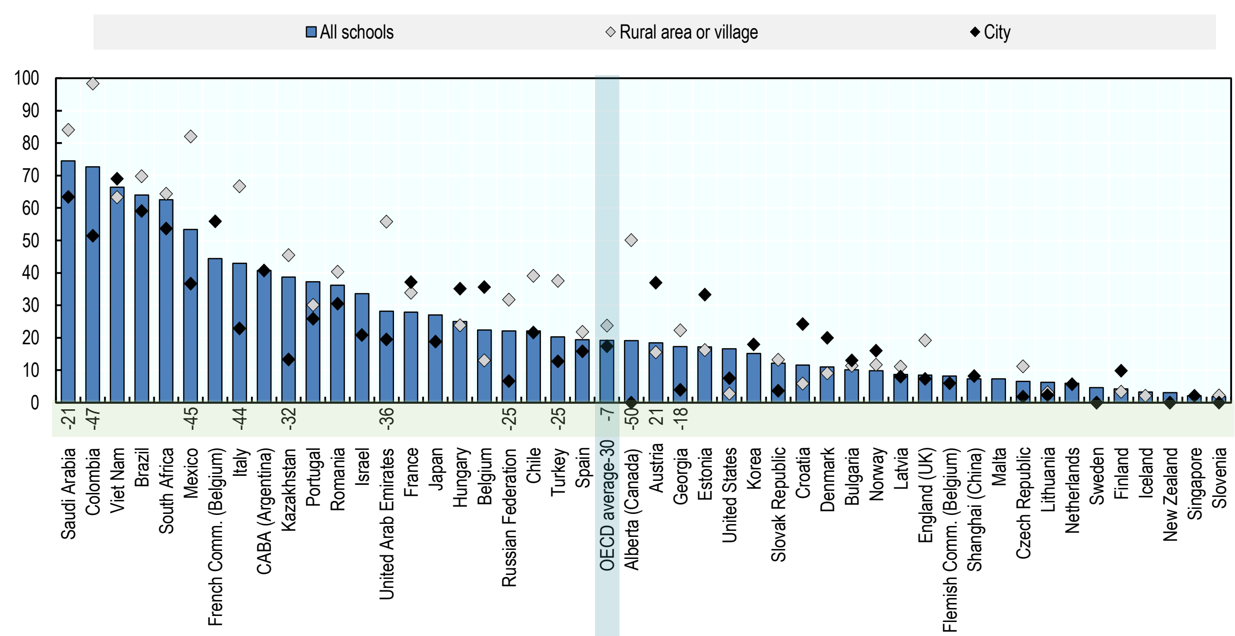
In various education systems, socio-economically disadvantaged schools are more likely to face issues with Internet access that hinder the quality of instruction than advantaged schools. On average across OECD countries and territories, the share of principals reporting that the school's capacity to provide quality instruction was hindered “quite a bit” or “a lot” by insufficient Internet access is 9 percentage points higher in socio-economically disadvantaged schools than in advantaged schools (Table 3.4). The countries and territories where the largest differences in the availability of ICT equipment are observed between advantaged and disadvantaged schools are also the ones with the largest differences in terms of adequate Internet access. These are CABA (Argentina) (67 percentage points), Colombia (54 percentage points), Mexico (41 percentage points) and South Africa (30 percentage points). It is only in Shanghai (China) where the share of principals reporting insufficient Internet access as a factor hampering quality instruction is higher in schools attended by more advantaged students than in disadvantaged schools.

According to TALIS findings, students are more likely to have sufficient Internet access in private schools than in public schools. This holds in half of the countries and territories with available data. On average across the OECD, the share of principals who reported that the school's capacity to provide quality instruction was hindered "quite a bit" or "a lot" by insufficient Internet access is 14 percentage points higher in public schools than in private schools (Table 3.4). The largest differences (above 45 percentage points) can be observed in Latin American countries and territories such as CABA (Argentina), Colombia and Mexico. As for ICT equipment, in most education systems, private schools tend to have more resources in providing adequate Internet access for teachers and students.

In many education systems, providing adequate Internet access is more challenging in schools located in rural areas than those in cities. On average across OECD countries and territories, the share of principals who reported that the school's capacity to provide quality instruction was hindered by insufficient Internet access is 7 percentage points higher in rural schools than in schools located in cities (Figure 3.2). This difference between rural and city schools is above 40 percentage points in Alberta (Canada), Colombia, Italy and Mexico. These results may reflect the general gaps in connectivity and Internet access that persist between urban and rural areas in virtually all countries (International Telecommunication Union, 2020[27]). A reverse pattern is observed in only one country. Similar to school resources with respect to ICT equipment, in Austria the share of principals who reported that the school's capacity to provide quality instruction was hampered by insufficient Internet access is higher (by 21 percentage points) in city schools than in rural schools.

Figure 3.2. Insufficient Internet access, by school location

Percentage of lower secondary principals who report that the school's capacity to provide quality instruction is currently hindered "quite a bit" or "a lot" by insufficient Internet access



Note: Statistically significant differences between privately managed schools and publicly managed schools are shown next to the country/territory name (see Annex B).
Countries and territories are ranked in descending order of the percentage of principals who report that the school's capacity to provide quality instruction is currently hindered "quite a bit" or "a lot" by insufficient Internet access.
Source: OECD, TALIS 2018 Database, Table 3.4.

StatLink https://stat.link/ahc0qf

Do students have access to teachers who are trained and feel self-efficient in the use of ICT?

Adequate ICT infrastructure is essential for effective digital learning in school. However, it is equally important that students have access to teachers who are trained in and feel capable of using ICT. Past studies have shown that access to technology alone will not improve student learning; effective integration of technology into teaching and learning requires teachers who are well-trained and able to use digital tools for instruction (Fraillon et al., 2019[15]; OECD, 2021[9]; OECD, 2019[14]; OECD, 2015[3]). However, teachers can only integrate technology into their teaching if they themselves acquire basic digital skills and are competent enough to tailor technology use to their own teaching (OECD, 2019[14]). Teachers can improve their digital skills in their initial education and training and as part of their in-service professional development activities. Pre- and in-service training can also inform teachers about pedagogical practices that work well with digital tools. For instance, a past PISA-based study showed that teachers who rely on certain teaching practices such as inquiry-based, project-based, problem-based or co-operative pedagogies tend to be more successful in integrating new technologies into their teaching (OECD, 2015[3]). Technology use seems especially effective when it is blended with innovative teaching and learning methods such as gamification or flipped classes (Paniagua and Istance, 2018[28]; Peterson et al., 2018[29]). Besides teachers' training in the use of ICT, the literature consistently highlights the positive relationship between teachers' perceived self-efficacy and their use of digital technology in the classroom (Drossel, Eickelmann and Gerick, 2016[30]; Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017[7]; Hatlevik and Hatlevik, 2018[31]; Hsu, 2016[32]; Nikolopoulou and Gialamas, 2016[33]). Thus, both teachers' training and perceived self-efficacy in ICT use are important factors to consider when analysing digital divides.

Allocation of teachers trained in the use of ICT as part of initial education and training

In line with the research literature that suggests a positive relationship between the inclusion of ICT use in teachers' initial education and training and the use of ICT in school (Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017[7]; Tondeur et al., 2018[34]), past analyses of TALIS 2018 data show that pre-service teacher education and training is an important driver of teachers' adoption of digital technology for their teaching activities (OECD, 2020[35]). In almost one-third of TALIS countries and territories with available data, teachers are more likely to let students "frequently" or "always" use ICT for projects or class work when ICT for teaching was included in their formal education and training (OECD, 2020[35]).

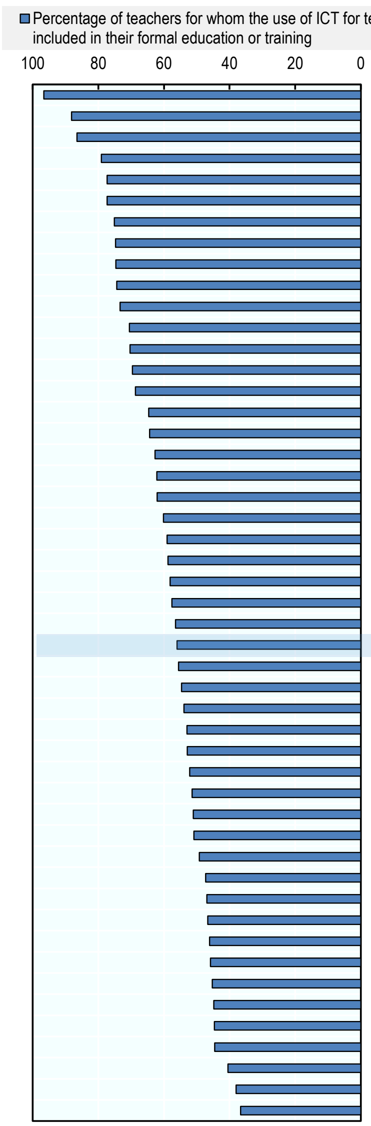
TALIS not only collects data on the content of teachers' initial education and training but also allows the quality of pre-service education to be gauged. Notably, TALIS asked teachers how well prepared they felt for the use of ICT in relation to their education and training (i.e. "not at all"; "somewhat"; "well"; and "very well)". On average across OECD countries, 56% of teachers received training in the use of ICT in their initial education (Figure 3.3) and 43% felt well or very well prepared for the use of technology (Table 3.6). There is, however, substantial variation between countries and territories.

Figure 3.3. Teachers' formal training in the use of ICT for teaching, by school characteristics

Results based on responses of lower secondary teachers and principals

A	City - rural area
B	Private - public schools
C	High - low concentration of disadvantaged students[1]

+	Positive difference
-	Negative difference
	Difference is not significant
	Missing values



	Difference in the share for whom the use of ICT for teaching was included in their formal education or training, by school characteristics (percentage-point)		
	A	B	C
Viet Nam		-3	3
Singapore		-13	
United Arab Emirates			5
Shanghai (China)			
Mexico			
Chile			
Kazakhstan	-7	-14	
Colombia		8	-11
England (UK)	-8	-5	6
Turkey	-8	-8	-4
Saudi Arabia			
Alberta (Canada)			
Malta			
Romania	-17		
Russian Federation			
Australia*			7
Brazil			
United States			
South Africa		5	
Slovak Republic			
Japan		-30	
Korea			
New Zealand			
Israel			
Bulgaria			
Flemish Comm. (Belgium)			
OECD average-31	-2		2
Finland			
Latvia	11		
Estonia			
Slovenia	-9		
CABA (Argentina)			
Italy			
Hungary			
Belgium			
France		-14	12
Netherlands			
Croatia	-13		
Portugal		5	
Denmark			
Iceland			
Norway			
Lithuania			
Georgia			
French Comm. (Belgium)			
Czech Republic			
Austria			
Spain			
Sweden	-6		8
Edu. systems with a pos. diff.	1	3	6
Edu. systems with no diff.	29	26	28
Edu. systems with a neg. diff.	7	7	2

* For this country, estimates for sub-groups and estimated differences between sub-groups need to be interpreted with great care. See Annex A for more information.

Note: ICT refers to information and communication technology.

1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal to 10% of students from socio-economically disadvantaged homes.

Countries and territories are ranked in descending order of the share of teachers for whom the use of ICT for teaching was included in their formal education or training.

Source: OECD, TALIS 2018 Database, Table 3.5.

StatLink https://stat.link/tr1pak

The share of teachers who were trained in using digital technology for teaching during their formal education and training varies considerably (between 37% and 97%) across TALIS participants (Figure 3.3). The countries and territories where the large majority of teachers (more than 75%) received this type of initial training include Chile, Kazakhstan, Mexico, Singapore, Shanghai (China), the United Arab Emirates and Viet Nam. Similar to the inclusion of ICT use in formal education, the percentage of teachers who felt well prepared for the use of digital technology also varies across countries (between 20% to 86%) (Table 3.6). In Mexico, the United Arab Emirates and Viet Nam, more than 75% of teachers felt prepared in using ICT for teaching.

One way to examine whether students have access to teachers who were trained in the use of digital technology for teaching during their formal education and training is to look at whether the allocation of teachers trained in ICT use in a country's schools resembles the teacher population of the country. The dissimilarity index is a commonly used measure to analyse deviation from evenness (see Box 2.1 in Chapter 2 for more detail). It indicates the average proportions of teachers from both groups (i.e. teachers who were trained in the use of ICT and those who were not) that would need to be reallocated in order to obtain a distribution of teachers from these groups across all schools that is identical to the overall distribution within the country, assuming that school size in terms of the number of teachers working in the school is fixed. Alternatively, assuming that school size can be adjusted, the dissimilarity index can be interpreted as the proportion of one or the other group that has to be reallocated in order to achieve a distribution of teachers from these groups that mirrors the overall population.[7]

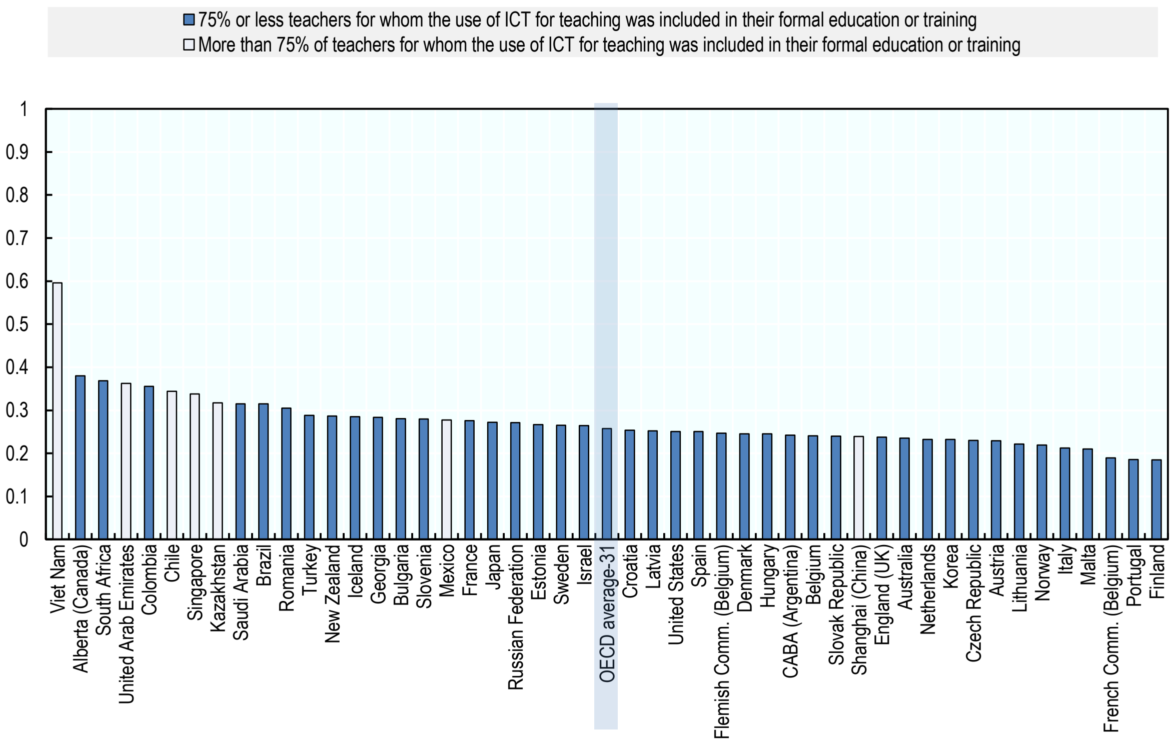
In most countries and territories participating in TALIS, between 21% and 35% of teachers who were trained in the use of digital technology would need to move to another school in order to achieve a distribution of teachers in all schools that is similar to the one observed in the overall teacher population (Figure 3.4). Yet, in some countries and territories such as Alberta (Canada), Colombia, South Africa, the United Arab Emirates and Viet Nam the index is above 0.35 while at the other end of the spectrum, it is below 0.23 in Finland, the French Community of Belgium, Italy, Malta, Norway and Portugal. Thus, in the large majority of countries participating in TALIS, the dissimilarity index ranges between 0.23 and 0.35**.**

When interpreting the dissimilarity index, the focus is on countries and territories where the overall share of teachers with the specific characteristic analysed is 75% or less. By design, the value of the dissimilarity index tends to be high when the share of teachers with a certain characteristic in the overall teacher population is either very small or large (see Box 2.1 in Chapter 2). Thus, one also needs to take into account the overall share of teachers with certain characteristics when interpreting the results of the dissimilarity index. If the overall share of teachers who were trained in the use of ICT during pre-service training is low, a high value of the dissimilarity index means that there might be schools where no teacher had formal training in the use of ICT. On the contrary, if the majority of teachers were trained in how to use digital technology for instruction, then even in the case of an uneven distribution of teachers, most schools have at least one teacher trained in the use of ICT, and collaboration and knowledge-sharing among teachers would spread the effective use of digital technology in the school. Hence, an uneven allocation of teachers is less concerning in education systems where most teachers have been trained in the use of ICT. For instance, in the case of Viet Nam, where 97% of teachers reported that the use of ICT for teaching had been included in their formal education or training (Figure 3.3), its high dissimilarity index value should not be a major concern for equity (Figure 3.4).It is plausible to assume that most teachers were trained in the use of ICT in all schools. Albeit to a lesser extent, the same holds for Singapore, the United Arab Emirates, Shanghai (China), Chile and Mexico, where more than 75% of teachers had initial training in ICT use.

As expected based on past TALIS findings, the dissimilarity indices for use of ICT for teaching in formal education and training and teachers' sense of preparedness in ICT for teaching tend to be correlated (the linear correlation coefficient (r) = 0.61) (Tables 3.5 and 3.6). In some countries such as South Africa, both indicators are relatively high (i.e. dissimilarity index above 0.35) while in others, including Italy, Malta, Norway and Portugal, they are at the lower end (i.e. dissimilarity index above 0.23).

Figure 3.4. Allocation of teachers who had formal training in the use of ICT for teaching

Dissimilarity index for lower secondary teachers for whom the use of ICT for teaching was included in their formal education or training



Notes: ICT refers to information and communication technology.

The dissimilarity index measures if the allocation of teachers with a given characteristic in a country's schools resembles the overall teacher population of the country and it ranges from 0 (i.e. the allocation of teachers in schools resembles perfectly the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school). By design, the value of the dissimilarity index is high when the share of teachers with a certain characteristic in the overall teacher population is either very small or large. Thus, cross-country comparability warrants caution.

Countries and territories are ranked in descending order of the dissimilarity index for teachers for whom the use of ICT for teaching was included in their formal education or training.

Source: OECD, TALIS 2018 Database, Table 3.5.

StatLink https://stat.link/klnj2z

The uneven allocation of teachers with certain characteristics does not necessarily mean that a school system is inequitable. Education systems may deliberately allocate more resources (e.g. teachers who are proficient in the use of ICT for teaching) to disadvantaged schools to provide all students with access to digital learning resources at home. Hence, it is warranted to look more closely at the nature of the differences across schools in students' access to teachers who were trained and felt prepared to use ICT.

In certain education systems, teachers who were ICT-trained tend to work in socio-economically disadvantaged schools. The share of teachers who reported that they were trained in the use of ICT during their initial education and training is higher in schools where more than 30% of students are from socio-economically disadvantaged homes than in schools where 10% or less of the students have socio-economically disadvantaged family background in Australia, England (United Kingdom), France, Sweden, the United Arab Emirates, Viet Nam and on average across the OECD (Figure 3.3). The largest differences are observed in France (12 percentage points), Sweden (8 percentage points) and Australia (7 percentage points). These results may point to a generational effect. TALIS 2018 results show that novice teachers, who had their initial education more recently, are more likely to be trained in ICT and work in disadvantaged schools than their experienced colleagues – see Tables I.4.13 and I.4.32 in *TALIS 2018 Results: Volume I* (OECD, 2019[36]). Yet, there are two countries – Colombia and Turkey – where the share of teachers who were trained in the use of digital technology during their initial education is larger in socio-economically advantaged schools than in disadvantaged schools. In Colombia, the proportion of teachers who were trained in the use of ICT is 11 percentage points higher in socio-economically advantaged schools than in disadvantaged schools.

TALIS data show that teachers working in more challenging environments are more likely to have felt that their formal education and training prepared them to use digital technology in CABA (Argentina), England (United Kingdom), France, the United Arab Emirates and Viet Nam. In these countries and territories, the share of prepared teachers is higher in schools with more than 30% of students from socio-economically disadvantaged homes than in schools where 10% or less of the students are from socio-economically disadvantaged homes (Table 3.6). These results may also point to a generational effect. While the share of novice teachers who felt prepared for the use of ICT tends to be higher as compared to their more experienced colleagues – see Table I.4.20 in *TALIS 2018 Results: Volume I* (OECD, 2019[36]) – novice teachers are also more likely to work in disadvantaged schools. Yet, similar to teachers' allocation with respect to the inclusion of ICT in their initial education and training, the share of teachers who felt prepared to use digital technology is higher in socio-economically advantaged schools than in disadvantaged schools in Colombia and Turkey. The same pattern is observed in Mexico and Saudi Arabia.

Teaching students whose first language is different from the language(s) of instruction may require additional effort and different teaching strategies from the teacher. Hence, a school where the share of students whose first language is different from the language of instruction is high can be considered more challenging. TALIS data suggest that there are countries and territories where schools with a higher concentration of such students are more likely to employ teachers who were trained in ICT during their initial education and training (Table 3.5). Notably, in Alberta (Canada), the Flemish Community of Belgium, Latvia, Turkey, Viet Nam and on average across the OECD, the share of ICT-trained teachers is higher in schools where the first language of more than 30% of students is different from the language of instruction than in schools where the proportion of these types of students is 10% or less. Since these countries and territories tend to have either two or more official languages or important language minorities, these results suggest that school systems provide extra resources to schools where the language of instruction is different from the first language of a large share of the students. The opposite pattern is only observed in the United Arab Emirates.

In addition, schools with a higher concentration of students whose first language is different from the language(s) of instruction are more likely to employ teachers who felt that their initial education and training had prepared them to use ICT in Latvia, England (United Kingdom), Turkey and on average across the OECD (Table 3.6). Thus, in the case of Latvia and Turkey, more challenging learning environments that are characterised by a high share of students whose first language is different from the language of instruction tend to be compensated by teachers who were trained in and felt prepared for the use of ICT. On the contrary, in Singapore, the Russian Federation and the United Arab Emirates, the share of teachers who felt prepared for the use of digital technology is higher in schools where 10% or less of the students' first language is different from the language of instruction.

Depending on the country/territory, attending a private or public school can make a difference in students' access to teachers trained in the use of ICT. Among TALIS participants with available data, there are seven countries and territories – England (United Kingdom), France, Japan, Kazakhstan, Singapore, Turkey and the Viet Nam – where students attending public schools have a higher chance of being taught by teachers trained in the use of ICT than their peers in private schools (Figure 3.3). The opposite pattern is observed in Colombia, Portugal and South Africa.

As one would expect, the differences across private and public schools with respect to teachers' initial training and sense of preparedness in the use of ICT tend to be aligned. For instance, in France, Japan and Kazakhstan, public schools not only have higher shares of teachers who were trained in the use of ICT in formal education and training but also teachers who felt prepared in using ICT (Tables 3.5 and 3.6). However, in Colombia, private schools tend to have more teachers trained in and comfortable with ICT.

Students' access to teachers who were trained in and at ease with ICT may also depend on the location of the school. The share of teachers for whom the use of ICT for teaching was included in their formal education and training is 2 percentage points higher in schools located in rural areas or villages than in city schools on average across OECD countries (Figure 3.3). The two countries with the largest differences (13 percentage points or higher) are Croatia and Romania. The opposite pattern can be observed only in Latvia, where the share of teachers trained in the use of ICT in city schools is 11 percentage points higher than in rural schools.

The pattern in the differences in the share of teachers who felt comfortable with ICT by school location is mixed. In Estonia, Georgia and Latvia, the share of teachers who felt that their initial education and training prepared them to use ICT for teaching is at least 11 percentage points higher in city schools than in rural schools (Table 3.6). On the contrary, in Chile, Croatia, Kazakhstan, Romania and the United Arab Emirates, the share of teachers who felt prepared is between 8 and 13 percentage points higher in rural schools as compared to city schools.

Allocation of teachers trained in the use of ICT as part of continuous professional development

Given the rapid pace of technological change, the digital skills and related pedagogical practices teachers acquire in their initial education and training can quickly become obsolete. While digital literacy, which has become an essential skill in everyday life, can also be acquired outside of formal education, continuous professional development in ICT use has an important role in addressing digital divides. In-service training in the use of digital technology can help teachers to continuously validate and update their ICT skills. Moreover, professional development can foster positive attitudes towards ICT integration in teaching and learning. As shown by past research, teachers' professional development in ICT use tends to have a positive indirect effect on ICT use in the classroom as teachers gain confidence in using ICT for instruction and related pedagogical practices (Alt, 2018[37]; Koh, Chai and Lim, 2017[38]).

Past analysis of TALIS 2018 data not only shows the importance of pre-service teacher education but also the crucial role of continuous professional development in teachers' adoption of digital technology for their teaching activities (OECD, 2020[35]). In almost all TALIS countries and territories with available data, teachers are more likely to let students "frequently" or "always" use ICT for projects or class work when ICT skills for teaching were included in their recent professional development activities (OECD, 2020[35]).

TALIS not only collects information about the content of continuous professional development activities attended by teachers but also how much professional development teachers need to integrate ICT skills into their teaching (i.e. "no need"; "low level of need"; "moderate level of need"; and "high level of need"). The information collected about teachers' needs helps policy makers implement effective professional development (OECD, 2020[39]; Opfer and Pedder, 2011[40]). There may be various different reasons for teachers' reporting a high level of need for professional development in the use of ICT skills (OECD, 2020[39]). It can signal that teachers want more training in this area due to their lack of knowledge or their dissatisfaction with previous training in digital technology. Yet, it is also possible that teachers simply want to invest more time in developing their ICT skills given that this knowledge field changes rapidly. Previous TALIS findings show that ICT skills for teaching is an area of continuous professional development where, on average across OECD countries and territories, there is a great need for in-service training and where participation is already high (OECD, 2020[39]). Thus, a high level of need for professional development in the use of ICT skills for teaching does not necessarily mean the lack of such skills. It can also signal that teachers who already use digital technology for teaching are willing to develop their ICT skills further. Analysis of TALIS data shows that teachers who report much need also tend to use ICT more on average across the OECD (Table 3.9). This suggests that a high level of need reflects teachers' eagerness to learn more rather than a critical lack of knowledge.[8]

On average across the OECD, 60% of teachers reported attending professional development focusing on ICT skills in the 12 months prior to the survey (Figure 3.5). This share varies between 33% and 93% across TALIS countries and territories while more than 75% of teachers participated in this type of professional development in Colombia, Kazakhstan, Latvia, the Russian Federation, Saudi Arabia, Shanghai (China), the United Arab Emirates and Viet Nam. The share of teachers who reported having a high level of need for in-service training in ICT skills ranges from 5% in England (United Kingdom) to 55% in Viet Nam (OECD average: 18%) (Table 3.8).

In almost all TALIS participants, the dissimilarity index for teachers for whom ICT skills for teaching was included in their professional development activities in the 12 months prior to the survey ranges between 0.24 and 0.40 (Figure 3.6). This means that between 24% and 40% of teachers who participated in professional development in the use of ICT would need to move to another school in order to achieve a distribution of teachers in all schools that is similar to the one observed in the overall teacher population. Countries and territories where the dissimilarity index for teachers' participation in professional development focusing on ICT skills is 0.41 or above are: Iceland, the United Arab Emirates and Viet Nam. Yet, it is important to note that the United Arab Emirates and Viet Nam are among the countries where more than 75% of teachers reported attending professional development activities focusing on ICT skills in the 12 months prior to the survey. Thus, in these countries the large majority of students attend schools that have at least one teacher who received in-service training in the use of ICT.

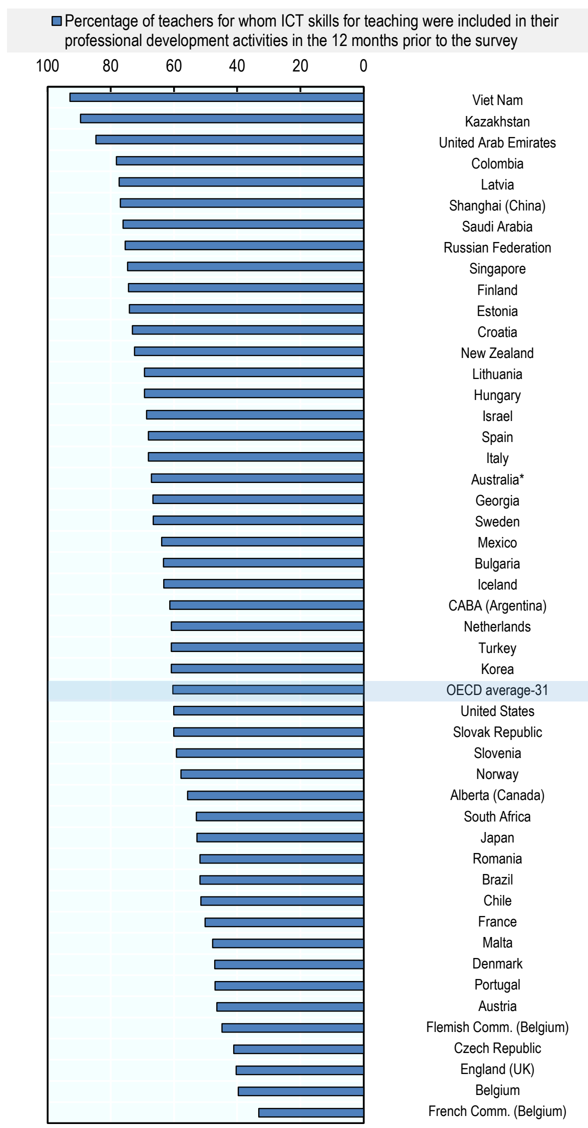
The distribution of teachers who reported a high level of need for in-service training in ICT skills across schools shows a different cross-country pattern to what is observed for teachers who participated in this type of professional development. The dissimilarity index indicates that, among TALIS participants, teachers who have a high level of need for in-service training in ICT skills are more likely to be concentrated in certain schools (i.e. dissimilarity index at 0.41 or above) in Alberta (Canada), Denmark, England (United Kingdom), the Flemish Community of Belgium, Iceland, Turkey and the United States (Table 3.8). However, it has to be noted that the overall share of teachers who reported needing professional development in the use of ICT is fairly low in these countries and territories, in particular in England (United Kingdom) (5%),Turkey (7%), Alberta (Canada) (8%) and the Flemish Community of Belgium (9%). Thus, the high dissimilarity index value reflects that, by design, the few teachers who have a high level of need for training in ICT skills are less likely to be distributed randomly across schools.

Figure 3.5. Teachers' participation in professional development in ICT skills, by school characteristics

Results based on responses of lower secondary teachers and principals

A: City - rural area
B: Private - public schools
C: High - low concentration of disadvantaged students[1]

+ Positive difference
- Negative difference
Difference is not significant
Missing values



Difference in the share of teachers for whom ICT skills for teaching were included in their professional development activities in the 12 months prior to the survey, by school characteristics (pecentage-point)

	A	B	C
Viet Nam			4
Kazakhstan		-7	4
United Arab Emirates			
Colombia			
Latvia			
Shanghai (China)			
Saudi Arabia			
Russian Federation			
Singapore			
Finland			
Estonia			-16
Croatia	-8		
New Zealand	29		
Lithuania			
Hungary			
Israel			
Spain	-11		
Italy			
Australia*	22	7	
Georgia			
Sweden			-7
Mexico		6	
Bulgaria			-10
Iceland			
CABA (Argentina)			
Netherlands			
Turkey			-5
Korea			
OECD average-31			
United States			
Slovak Republic			
Slovenia			
Norway		-13	
Alberta (Canada)			
South Africa		10	-9
Japan			
Romania			
Brazil		9	
Chile			
France		-17	8
Malta			
Denmark			
Portugal			
Austria			
Flemish Comm. (Belgium)		8	
Czech Republic			
England (UK)			-13
Belgium	10	9	
French Comm. (Belgium)			
Edu. systems with a pos. diff.	3	6	3
Edu. systems with no diff.	32	27	27
Edu. systems with a neg. diff.	2	3	6

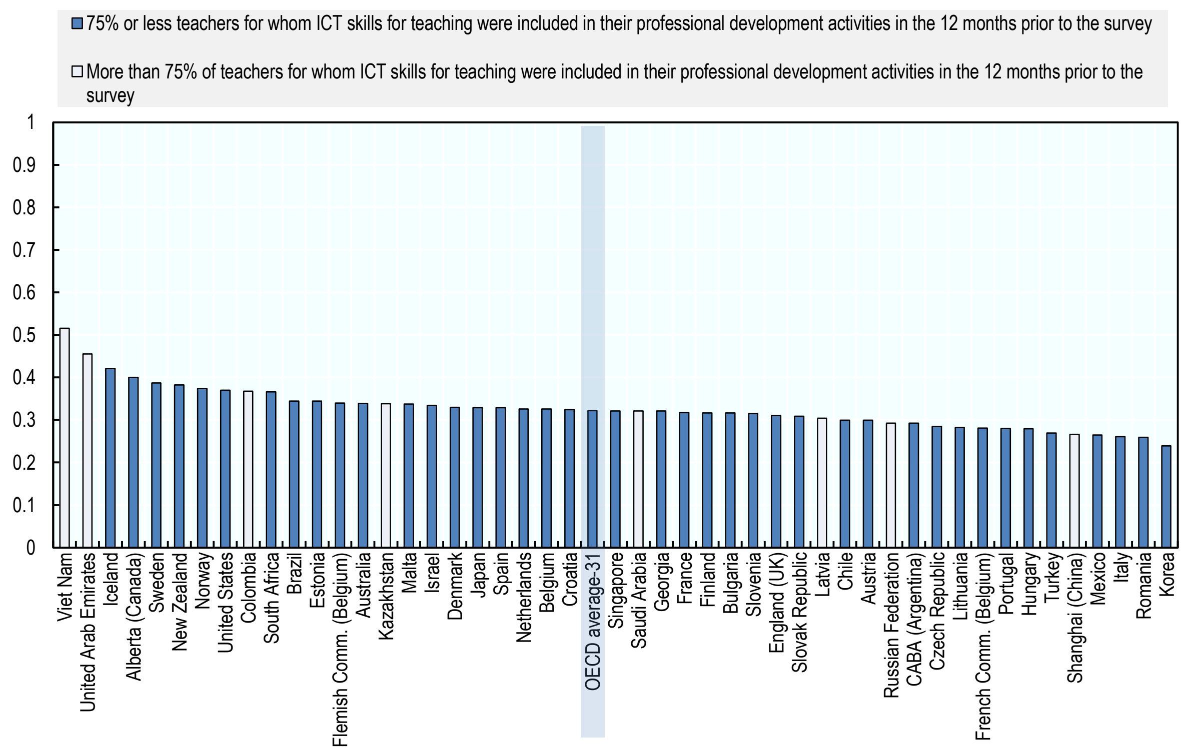
* For this country, estimates for sub-groups and estimated differences between sub-groups need to be interpreted with great care. See Annex A for more information.
Note: ICT refers to information and communication technology.
1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal to 10% of students from socio-economically disadvantaged homes.
Countries and territories are ranked in descending order of the share of teachers for whom the use of ICT for teaching was included in their formal education or training.
Source: OECD, TALIS 2018 Database, Table 3.7.

StatLink https://stat.link/n0zd2w

TALIS findings show no clear cross-country pattern of differences in the share of teachers attending in-service training in ICT skills and the proportion of those reporting a high level of need for such professional development between socio-economically advantaged and disadvantaged schools. The share of teachers for whom ICT skills for teaching were included in their professional development activities in the 12 months prior to the survey is higher in socio-economically disadvantaged schools (i.e. more than 30% of students are from socio-economically disadvantaged homes) than in advantaged schools (i.e. 10% of students from socio-economically disadvantaged homes or less) in France (8 percentage points), Kazakhstan (4 percentage points) and Viet Nam (4 percentage points) (Figure 3.5). Thus, in these education systems, teachers working in more challenging environments may have more access to in-service training in ICT skills or they may feel more need for or willingness to engage in such professional development. In Bulgaria, England (United Kingdom), Estonia, South Africa, Sweden and Turkey, the opposite pattern is observed. The difference in favour of advantaged schools is especially marked in Estonia (16 percentage points), England (United Kingdom) (13 percentage points) and Bulgaria (10 percentage points).

Figure 3.6. Allocation of teachers who participated in professional development in ICT skills

Dissimilarity index for lower secondary teachers for whom ICT skills for teaching were included in their professional development activities in the 12 months prior to the survey



Notes: ICT refers to information and communication technology.

The dissimilarity index measures if the allocation of teachers with a given characteristic in a country's schools resembles the overall teacher population of the country and it ranges from 0 (i.e. the allocation of teachers in schools resembles perfectly the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school). By design, the value of the dissimilarity index is high when the share of teachers with a certain characteristic in the overall teacher population is either very small or large. Thus, cross-country comparability warrants caution.

Countries and territories are ranked in descending order of the dissimilarity index for teachers for whom ICT skills for teaching were included in their professional development activities in the 12 months prior to the survey.

Source: OECD, TALIS 2018 Database, Table 3.7.

StatLink https://stat.link/hlpro3

In Georgia, Israel, Kazakhstan, Romania and South Africa, teachers teaching in more challenging environments are more likely to report more need for training in ICT skills than in schools with less than or equal to 10% of students from socio-economically disadvantaged homes (Table 3.8). The opposite pattern was observed in CABA (Argentina), Lithuania and Sweden, where the share of teachers who reported a high level of need for professional development in the use of ICT is between 5 and 6 percentage points higher in socio-economically advantaged schools than in disadvantaged schools.

Although in most countries and territories participating in TALIS, teachers' attendance of in-service training in ICT skills is similar across public and private schools, there are some exceptions. In Australia, Belgium (including its Flemish Community), Brazil, Mexico and South Africa, the share of teachers for whom ICT skills for teaching were included in their professional development activities in the 12 months prior to the survey is higher in private schools than in public schools (difference between 6 and 10 percentage points) (Figure 3.5). On the contrary, the share of teachers who attended in-service training on digital technology is higher in public than private schools in France, Kazakhstan and Norway. The difference in favour of teachers working in public schools is particularly large in France (17 percentage points) and Norway (13 percentage points).

In Brazil and South Africa, teachers in private schools are more likely to participate in the professional development of using ICT. They are also less likely to report a high level of need for such training compared to their colleagues working in public schools (Table 3.8). In Kazakhstan, while teachers teaching in public schools are more likely to participate in professional development on the use of digital technology, they are also more likely to feel more need for it than teachers working in private schools. Other countries where teachers teaching in public schools are more likely to report a high level of need for professional development in the use of ICT include Denmark and Estonia. The only TALIS participant where the opposite pattern was observed was Shanghai (China).

Based on TALIS results, in certain education systems, the location of the school may matter for teachers' participation in or need for professional development in the use of ICT. In Australia, Belgium and New Zealand, teachers for whom ICT skills for teaching were included in their professional development activities in the 12 months prior to the survey tended to be concentrated in cities (Figure 3.5). The difference between city and rural schools in the share of teachers whose professional development activities included ICT skills for teaching is particularly large in New Zealand (29 percentage points) and Australia (22 percentage points). In general, teachers' access to professional development activities may be more limited in remote areas due to the higher costs of delivering in-service training (Echazarra and Radinger, 2019[24]). Yet, the differences observed in Australia and New Zealand may also reflect the specific educational context of their remote areas. On the contrary, in Croatia and Spain, the share of teachers for whom ICT skills for teaching were included in their professional development activities in the 12 months prior to the survey is higher in rural schools than in cities.

The share of teachers who reported a high level of need for professional development in the use of ICT tends to be higher in cities than in rural areas in Croatia, Denmark and France (Table 3.8). Georgia is the only TALIS participant where teachers working in cities are less likely to report needing professional development in digital technology than their colleagues teaching in rural schools.

Allocation of teachers with high self-efficacy in the use of ICT

There is consensus among educational researchers, policy makers and practitioners that teachers' self-efficacy is strongly associated with their pedagogical practices and quality of instruction (Ainley and Carstens, 2018[41]; Holzberger, Philipp and Kunter, 2013[42]). Thus, as one would expect, teachers who feel they can use digital technology for instruction are more likely to use ICT tools (Drossel, Eickelmann and Gerick, 2016[30]; Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017[7]; Hatlevik and Hatlevik, 2018[31]; Hsu, 2016[32]; Nikolopoulou and Gialamas, 2016[33]). TALIS data also show that teachers who feel they can support student learning through the use of digital technology "quite a bit" or "a lot"[9] are more likely to “frequently” or “always” let students use ICT for projects or class work. This holds true while controlling for teacher characteristics, teacher training in the use of ICT and classroom composition (Table 3.9).

While exploring how teachers with high self-efficacy in ICT use are distributed across schools, it is also important to examine the relationship between teachers’ age and confidence in using digital technology. As one would expect, younger teachers tend to report more self-efficacy in ICT use than their colleagues. According to TALIS data, the older teachers are, the lower their self-efficacy is in ICT use (Table 3.10). This holds true in around half of the countries and territories participating in TALIS as well as on average across the OECD. This association holds in around one-fourth of TALIS participants and on average across the OECD even while accounting for other teacher characteristics,[10] teacher training in the use of ICT and classroom composition (Table 3.11).

The share of teachers with high self-efficacy in the use of ICT for teaching varies between 35% and 88% across countries and territories participating in TALIS (Figure 3.7). The countries and territories where the large majority (more than 75%) of teachers feel they can support student learning through the use of digital technology “quite a bit” or “a lot” include Alberta (Canada), Australia, Chile, Colombia, Denmark, Hungary, Italy, Kazakhstan, New Zealand, Portugal, Saudi Arabia, Turkey and the United Arab Emirates.

On average across OECD countries and territories, around one-third of teachers who feel they can support student learning through the use of digital technology would need to move to another school so that the distribution of teachers across schools mirrors the overall teacher population (Figure 3.8). Teachers with high self-efficacy in ICT use tend to be more concentrated in certain schools (i.e. dissimilarity index above 0.35) in Alberta (Canada), Belgium, Colombia, Denmark, Hungary, New Zealand, Turkey, the United Arab Emirates and the United States as compared to other countries and territories participating in TALIS. Also important to note, a large majority (more than 75%) of teachers report high self-efficacy in the use of ICT in most of the countries and territories with high dissimilarity index values. The unequal allocation of teachers should be less of a concern in these countries. At the other end of the spectrum, teachers who feel they can support student learning through the use of ICT are more evenly distributed across schools (i.e. dissimilarity index below 0.24) in Estonia, France, Korea, Malta, Shanghai (China) and Slovenia.

Students’ access to teachers with high self-efficacy in digital technology tends to differ depending on whether the school they attend is privately or publicly managed. In almost one-fourth of the countries and territories participating in TALIS, the share of teachers who feel they can support student learning through the use of digital technology “quite a bit” or “a lot” is higher in private schools than in public schools (Figure 3.7). In five countries, this difference reaches 10 percentage points or more: Singapore (22 percentage points), Mexico (18 percentage points), Brazil (13 percentage points), Georgia (11 percentage points) and Belgium (10 percentage points). Thus, the fact that teachers who can use ICT with confidence tend to be more concentrated in certain schools in Belgium and the United Arab Emirates may partly result from differences between private and public schools. Teachers in private schools may report higher self-efficacy in ICT use because private schools tend to have better ICT infrastructure (Tables 3.3 and 3.4). On the contrary, in Chile, the Czech Republic, the French Community of Belgium, Norway and Viet Nam, the share of teachers who feel they can use ICT for teaching is higher in public schools than in private schools. In these countries and territories, students attending public schools are more likely to have teachers who feel capable of supporting teaching and learning with digital technology (Figure 3.7).

Figure 3.7. Teachers with high self-efficacy in the use of ICT for teaching, by school characteristics

Results based on responses of lower secondary teachers and principals

A	City - rural area
B	Private - public schools
C	High - low concentration of disadvantaged students[1]

+	Positive difference
-	Negative difference
	Difference is not significant
	Missing values

Difference in the share of teachers who feel they can support student learning through the use of digital technology "quite a bit" or "a lot", by school characteristics (percentage-point)

	A	B	C
Denmark			
Portugal	-7		
United Arab Emirates		2	
Kazakhstan			
Italy			
Hungary	-8		
Colombia			-11
Australia*	15	7	
Chile	-9	-8	
New Zealand			
Alberta (Canada)			14
Turkey	12		
Saudi Arabia			
Flemish Comm. (Belgium)			
Shanghai (China)			
Netherlands			
Malta			
Lithuania			
Korea			
Latvia			
Slovak Republic	-14	6	
United States	15		
Bulgaria			
OECD average-31			
Spain		8	
Norway		-15	
Romania			
Sweden			
Brazil		13	-8
CABA (Argentina)			-8
Czech Republic	-7	-10	
Viet Nam		-10	
Singapore		22	
Iceland			
England (UK)			
Georgia		11	
Croatia			
Mexico		18	-12
Finland		8	
Belgium		10	-13
Slovenia			
Austria	-15		-9
Estonia			
Israel			
South Africa		9	-8
France			
Japan			
French Comm. (Belgium)		-5	
Edu. systems with a pos. diff.	3	11	1
Edu. systems with no diff.	27	20	28
Edu. systems with a neg. diff.	6	5	7

* For this country, estimates for sub-groups and estimated differences between sub-groups need to be interpreted with great care. See Annex A for more information.

Note: ICT refers to information and communication technology.

1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal to 10% of students from socio-economically disadvantaged homes.

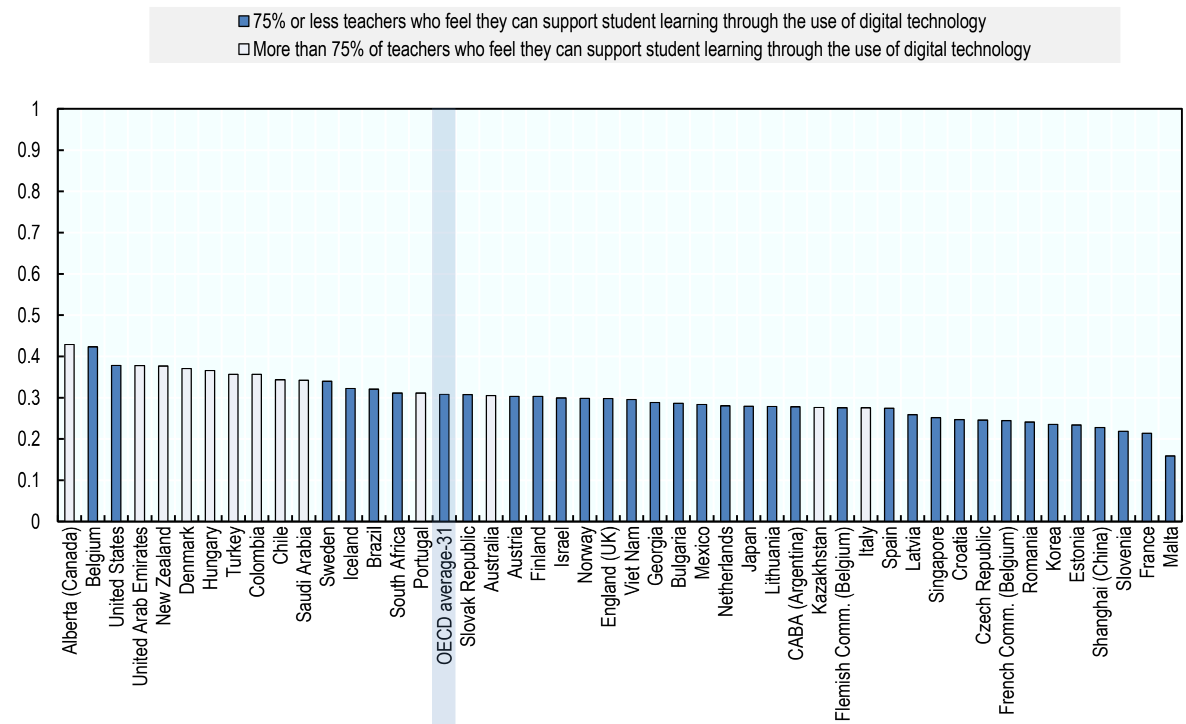
Countries and territories are ranked in descending order of the share of teachers who feel they can support student learning through the use of digital technology "quite a bit" or "a lot".

Source: OECD, TALIS 2018 Database, Table 3.12.

StatLink https://stat.link/0tykvq

Figure 3.8. Allocation of teachers with high self-efficacy in the use of ICT for teaching

Dissimilarity index for lower secondary teachers who feel they can support student learning through the use of digital technology "quite a bit" or "a lot"



Notes: ICT refers to information and communication technology.

The dissimilarity index measures if the allocation of teachers with a given characteristic in a country's schools resembles the overall teacher population of the country and it ranges from 0 (i.e. the allocation of teachers in schools resembles perfectly the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school). By design, the value of the dissimilarity index is high when the share of teachers with a certain characteristic in the overall teacher population is either very small or large. Thus, cross-country comparability warrants caution.

Countries and territories are ranked in descending order of the dissimilarity index for teachers who feel they can support student learning through the use of digital technology "quite a bit" or "a lot".

Source: OECD, TALIS 2018 Database, Table 3.12.

StatLink https://stat.link/yevkgn

TALIS findings suggest that there are some countries and territories where teachers with high self-efficacy in ICT tend to work in socio-economically advantaged schools. In Austria, Belgium, Brazil, CABA (Argentina), Colombia, Mexico and South Africa, the share of teachers who reported high self-efficacy in supporting student learning through the use of digital technology is higher in schools with 10% of students from socio-economically disadvantaged backgrounds or less than in schools with more than 30% of disadvantaged students (Figure 3.7). Thus, in these countries and territories, students from disadvantaged backgrounds, who tend to be less exposed to digital learning at home, are also less likely to have access to teachers with high self-efficacy in teaching with ICT at school. The largest difference in favour of socio-economically advantaged schools is observed in Belgium (13 percentage points), which also happens to be the country with one of the most uneven distribution of teachers across schools according to the dissimilarity index. Similar to the gap between private and public schools, teachers working in socio-economically advantaged schools may report higher self-efficacy in digital technology because these schools tend to have more adequate ICT infrastructure (Tables 3.3 and 3.4).

Table 3.1 shows that the share of teachers who feel they can use ICT is higher in schools where the quality of instruction is not hindered by inadequate digital infrastructure. It is only in Alberta (Canada) that disadvantaged students are more likely to have teachers with high self-efficacy in the use of ICT than their more affluent peers.

In a few education systems, school location can matter in terms of students' access to teachers with high self-efficacy in ICT. In Australia, Turkey and the United States, the share of teachers who reported high self-efficacy in the use of digital technology is higher in schools located in cities than in rural schools (Figure 3.7). These differences amount to 15 percentage points in Australia and the United States. In the case of Australia, the self-efficacy of teachers in rural schools may be hindered by their more limited participation in professional development activities focusing on ICT skills (Table 3.7). The uneven allocation of teachers with high self-efficacy in ICT in the United States, as shown by the dissimilarity index, may be partly explained by school location. In contrast, other countries such as Austria, Chile, the Czech Republic, Hungary, Portugal and the Slovak Republic show a higher proportion of teachers in rural than urban schools who report high self-efficacy in ICT. This can be explained by rural schools often having fewer students, lower student-teacher ratios and better school climate, which in turn result in more supportive learning environments and better disciplinary climate (Echazarra and Radinger, 2019[24]).

Do students have access to teachers who use ICT for teaching on a regular basis?

Past findings based on PISA data show that providing access to ICT tools at school does not automatically lead to better student outcomes (Borgonovi and Pokropek, 2021[4]; OECD, 2019[14]; OECD, 2015[3]). According to recent research, students who use ICT either a lot or a little tend to have lower levels of reading achievement than students who engage in medium levels of use of digital technology (Borgonovi and Pokropek, 2021[4]). This means that both too limited and overly excessive use of ICT can be associated with lower student achievement. Yet, teachers' and students' ability to make the most of ICT for teaching and learning is reinforced by regular and judicious use of digital technology in the classroom. Past research highlights the positive relationship between teachers' perceived self-efficacy and their use of digital technology in the classroom (Drossel, Eickelmann and Gerick, 2016[30]; Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017[7]; Hatlevik and Hatlevik, 2018[31]; Hsu, 2016[32]; Nikolopoulou and Gialamas, 2016[33]). Therefore, it is worth examining if teachers who "frequently" or "always" use ICT for teaching are distributed evenly across schools and if schools with different characteristics differ in the share of teachers who use digital technology for instruction on a regular basis.

As it was shown in the previous section, younger teachers tend to report higher self-efficacy in ICT use (Tables 3.10 and 3.11). The question arises whether younger teachers are also more likely to let students use ICT[11] on a regular basis than their colleagues. Based on TALIS data, the fact that younger teachers tend to report higher self-efficacy in ICT use does not necessarily result in more frequent use of digital technology in their teaching. In almost one-third of the countries and territories participating in TALIS, teachers' age and the frequency of ICT use for instruction are positively associated (Table 3.13). This signals the presence of confounding factors. Younger teachers' use of digital technology in the classroom may be hampered by the fact that they tend to work in more challenging schools. School principals of disadvantaged schools are more likely to report that instruction is hindered by the lack of adequate ICT infrastructure (Tables 3.3 and 3.4). The relationship between teachers' age and the regular use of ICT for teaching remains significant only in a couple of countries and territories when other teacher characteristics,[12] ICT training, and classroom composition are accounted for (Table 3.14).

Based on past TALIS findings, letting students use ICT on a regular basis is not as widespread as other teaching strategies such as practices involving classroom management and clarity of instruction. On average across the OECD, about 53% of teachers reported that they "frequently" or "always" let students use ICT for projects or class work[13] (OECD, 2019[36]). Unlike those more common teaching practices, the use of ICT for teaching and learning may require additional school resources as well as teachers who are able to use ICT for teaching effectively. As shown in the previous sections, teachers who are trained in and feel capable of using ICT may concentrate in certain types of schools. At the same time, there are also differences in students' access to ICT equipment and adequate Internet across schools. It is worth looking at whether students have fair access to teachers who use ICT for teaching on regular basis.

Allocation of teachers who use ICT for teaching on a regular basis

Overall, the share of teachers who reported "frequently" or "always" letting students use ICT for projects or class work varies a lot (between 15% and 90%) across countries and territories that participated in TALIS (Figure 3.9). While in Denmark (90%), New Zealand (80%), Australia (78%) and the United Arab Emirates (77%), most teachers frequently use technology for teaching, less than 20% of teachers regularly do in the French Community of Belgium and Japan.

On average across the OECD, around one-third of teachers who regularly use ICT in the classroom would need to move to another school for them to be distributed evenly across schools (Figure 3.10). Teachers who use ICT in class on a regular basis are more unevenly distributed across schools (i.e. dissimilarity index above 0.35) in Alberta (Canada), Australia, Denmark, Iceland, Japan, the Netherlands, New Zealand, Saudi Arabia, Sweden, the United Arab Emirates, the United States and Viet Nam than in the rest of countries and territories participating in TALIS. However, as the large majority (more than 75%) of teachers reported using ICT for teaching on a regular basis in Australia, Denmark, New Zealand and the United Arab Emirates, the uneven distribution of teachers, as indicated by the dissimilarity index, should be less of a concern in these countries. It is plausible that, in these countries, most schools employ teachers who frequently use ICT for teaching. At the other end of the spectrum, in Croatia, Estonia, France, Lithuania, Malta and Portugal, teachers who regularly use ICT for instruction are more evenly distributed across schools (i.e. dissimilarity index below 0.25).

TALIS results suggest that the differences across schools in the use of ICT are most pronounced between private and public schools. In almost one-fourth of the countries and territories participating in TALIS, the share of teachers who reported "frequently" or "always" letting students use ICT for projects or class work is higher in private schools than in public schools (Figure 3.9). The three countries with the largest differences are Singapore (35 percentage points), Australia (11 percentage points) and Spain (10 percentage points). In these education systems, students attending private schools are more likely to be exposed to digital learning at school than their peers who attend public schools. Teachers in private schools may use ICT for instruction more regularly since private schools tend to have better ICT infrastructure (Tables 3.3 and 3.4). Also, students attending private schools may have better access to digital learning resources at home, which in turn, helps teachers implement digital learning at school more smoothly and effectively. The opposite pattern is observed in three countries. The share of teachers who "frequently" or "always" let students use ICT is at least 10 percentage points higher in public schools than in private schools in Chile, the Flemish Community of Belgium and Turkey.

Figure 3.9. Teachers' regular use of ICT for teaching, by school characteristics

Results based on responses of lower secondary teachers and principals

A	City - rural area
B	Private - public schools
C	High - low concentration of disadvantaged students[1]

+	Positive difference
-	Negative difference
	Difference is not significant
	Missing values

	Difference in the share of teachers who report to "frequently" or "always" let students use ICT for projects or class work, by school characteristics (pecentage-point)		
	A	B	C
Denmark			
New Zealand			
Australia*		11	-13
United Arab Emirates		8	-9
Colombia			
Russian Federation			
Mexico		5	
Turkey	8	-10	
Kazakhstan			
Alberta (Canada)			16
CABA (Argentina)			
Chile	-14	-12	
Sweden			
Lithuania			
United States	13		
Portugal			
Romania			
Iceland			
Georgia	6		
OECD average-31			-2
Israel			
Spain		10	
Netherlands			
Finland		7	
Saudi Arabia			
Latvia			
Hungary			
Malta		7	
Slovak Republic		8	
Italy	-9		
Croatia			
Estonia			
Bulgaria			
Viet Nam	16		-19
Singapore		35	
Brazil		8	
England (UK)			-13
South Africa			
Flemish Comm. (Belgium)		-12	10
Slovenia			
France		5	
Czech Republic			
Austria	-12		
Korea			
Belgium			
Shanghai (China)		7	
French Comm. (Belgium)			
Japan			
Edu. systems with a pos. diff.	4	11	2
Edu. systems with no diff.	29	21	30
Edu. systems with a neg. diff.	3	3	4

* For this country, estimates for sub-groups and estimated differences between sub-groups need to be interpreted with great care. See Annex A for more information.

Note: ICT refers to information and communication technology.

1. High concentration of disadvantaged students refers to schools with more than 30% of students from socio-economically disadvantaged homes. Low concentration of disadvantaged students refers to schools with less than or equal to 10% of students from socio-economically disadvantaged homes.

Countries and territories are ranked in descending order of the share of teachers who report to "frequently" or "always" let students use ICT for projects or class work.

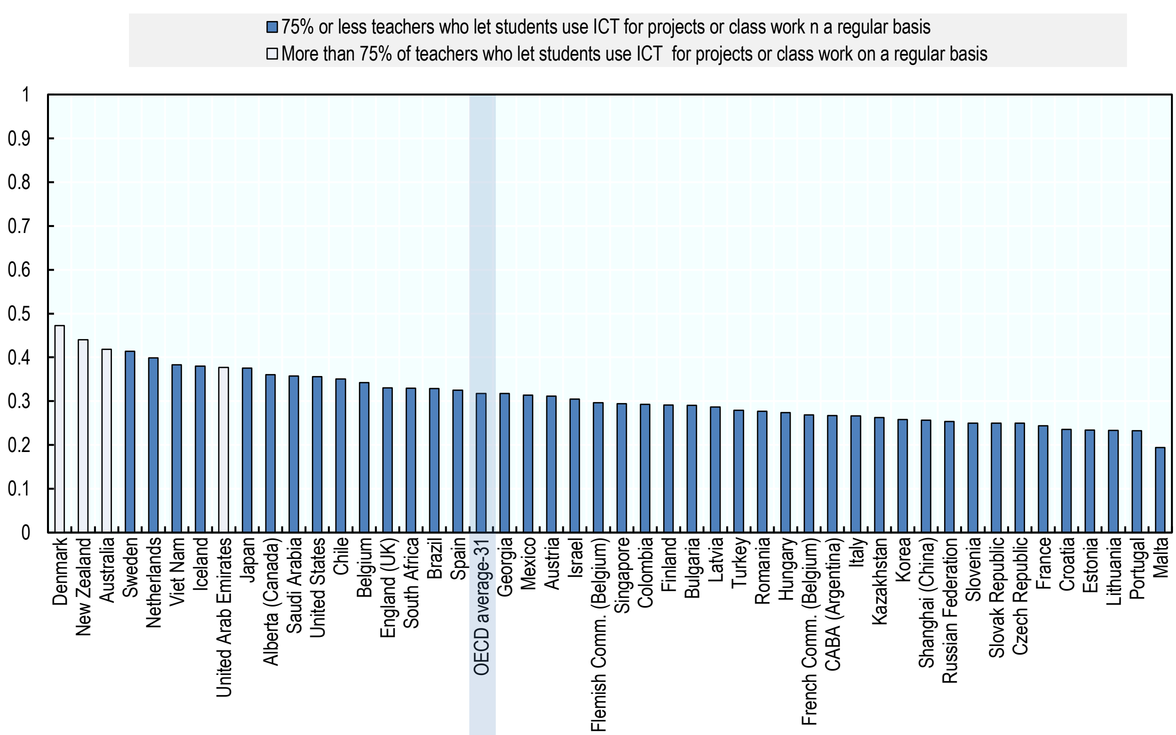
Source: OECD, TALIS 2018 Database, Table 3.15.

StatLink https://stat.link/u7bdof

In a few education systems, teachers' use of ICT may also vary depending on the concentration of students from socio-economically disadvantaged homes. In Australia, England (United Kingdom), the United Arab Emirates, Viet Nam and on average across OECD countries, the share of teachers who reported "frequently" or "always" letting students use ICT for projects or class work is higher in schools where 10% or less of the students are from socio-economically disadvantaged backgrounds than in schools with more than 30% of the students coming from disadvantaged backgrounds (Figure 3.9). This difference is above 10 percentage points in Viet Nam (19 percentage points), England (United Kingdom) (13 percentage points) and Australia (13 percentage points). Hence, in these school systems, disadvantaged students, who tend to have limited access to digital learning at home, are also less likely to be exposed to ICT use at school. Teachers working in schools with a lower share of students from socio-economically disadvantaged homes tend to have access to better ICT infrastructure at school (Tables 3.3 and 3.4). They also tend to teach students who have better access to digital learning resources at home. On the contrary, the share of teachers who frequently use ICT for teaching is higher in socio-economically disadvantaged schools than in advantaged schools in Alberta (Canada) (16 percentage points) and the Flemish Community of Belgium (10 percentage points). In these education systems, providing disadvantaged students with preferential access to digital learning at school may be a deliberate policy.

Figure 3.10. Allocation of teachers who use ICT for teaching on a regular basis

Dissimilarity index for lower secondary teachers who "frequently" or "always" let students use ICT for projects or class work



Notes: ICT refers to information and communication technology.
The dissimilarity index measures if the allocation of teachers with a given characteristic in a country's schools resembles the overall teacher population of the country and it ranges from 0 (i.e. the allocation of teachers in schools resembles perfectly the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school). By design, the value of the dissimilarity index is high when the share of teachers with a certain characteristic in the overall teacher population is either very small or large. Thus, cross-country comparability warrants caution.
Countries and territories are ranked in descending order of the dissimilarity index for teachers who "frequently" or "always" let students use ICT for projects or class work.
Source: OECD, TALIS 2018 Database, Table 3.15.

StatLink https://stat.link/7h8mu1

TALIS data suggest that in a couple of countries and territories regular use of ICT for teaching is lower in schools that have a higher concentration of students whose first language is different from the language(s) of instruction (Table 3.15). In Bulgaria, the French Community of Belgium, the Russian Federation and Singapore, the share of teachers who reported letting students use ICT in the classroom is 7 to 13 percentage points lower in schools with a higher share (more than 30%) of students whose first language is different from the language of instruction than in schools with a lower share (10% or less). The United Arab Emirates is the only country where students attending more multicultural schools in terms of language background are more likely to use ICT regularly in class. This may reflect the presence of affluent, non-English speaking expatriate families whose children tend to attend international schools where the language of instruction is typically English.

In some education systems teachers' use of digital technology for instruction varies depending on the share of students with special education needs at school. In Alberta (Canada), New Zealand, Singapore and the United Arab Emirates, the share of teachers who use ICT for teaching on a regular basis is 3 to 12 percentage points higher in schools where more than 10% of students have special education needs (Table 3.15). These findings may be explained by the use of assistive technologies for students with special education needs. Computer programmes and applications that support students with learning disabilities can provide a more personalised and helpful learning experience. There is empirical evidence showing a positive relationship between the use of assistive technologies and the improved outcomes of students with special needs (Maor, Currie and Drewry, 2011[43]) On the contrary, in Croatia and Hungary, the share of teachers who reported "frequently" or "always" letting students use ICT for projects or class work is 6 percentage points higher in schools where the concentration of students with special education needs is 10% or less.

School location can also matter for students' access to digital learning in the classroom. The share of teachers who usually let students use ICT for projects or class work is higher in schools located in cities than in rural schools in Viet Nam (16 percentage points), the United States (13 percentage points), Turkey (8 percentage points) and Georgia (6 percentage points) (Figure 3.9). Yet, in Austria, Chile and Italy, the share of teachers who let students use ICT in class on a regular basis is between 9 and 14 percentage points higher in rural areas than in cities. In the case of Austria, this result may be related to the finding that rural schools' ICT infrastructure tend to be better, as reported by school leaders (Tables 3.3 and 3.4).

How much do teacher characteristics and school resources in ICT infrastructure explain differences in the use of ICT across schools?

As described above, teachers who use ICT for teaching on a regular basis are not randomly allocated across schools. However, their uneven distribution does not necessarily imply that the school system is inequitable. Exposing students to digital learning at school is one way to compensate for limited access to digital learning at home. Yet, as shown in the previous section, the share of teachers who regularly use ICT in school is higher in private schools than in public schools. In a few education systems, there is also evidence that the share of this type of teachers is higher in socio-economically advantaged than disadvantaged schools. Hence, the question of how to enhance digital learning in public schools and less affluent schools arises. Should education systems aim to reallocate teachers who are trained in and feel capable of using ICT for teaching, which would provide all students with access to digital learning? Or should school systems provide better ICT infrastructure such as adequate ICT equipment and access to Internet to schools that are most in need?

One way to address these questions is to examine the share of the overall variation in teachers' frequent use of ICT that lies between schools once teacher and school characteristics have been taken into account.[14] If teachers' use of ICT no longer varies between schools when teacher characteristics have been taken into account, then reallocating teachers based on their years of experience, self-efficacy, initial education and continuous professional development in the use of digital technology may sufficiently provide all students with access to digital learning, irrespective of the school they attend. However, if the share of the overall variation in teachers' use of ICT that lies between schools remains significant after teacher characteristics have been adjusted for, then teacher allocation policies may not be enough. Similarly, if teachers' use of ICT no longer varies between schools when the quality of ICT equipment and Internet access are taken into account, then investment in ICT infrastructure may have an important role in addressing digital divides. Yet, if the share of the overall variation in teachers' use of ICT that lies between schools remains significant after the quality of schools' ICT equipment and Internet access have been taken into account, then investment in ICT infrastructure alone may not be enough to address inequities in students' access to digital learning at school.

TALIS results indicate that differences between schools in the use of ICT remain significant after controlling for teaching experience and teachers' self-efficacy, and initial education and continuous professional development in the use of ICT in all TALIS participants except for Malta (Table 3.16). On average across OECD countries, 34% of the variance in the propensity to let students use ICT is between schools after adjusting for teacher characteristics (Figure 3.11). Hence, based on TALIS data, inequities across schools in the use of ICT cannot be addressed only by reallocating teachers based on characteristics such as years of teaching experience, self-efficacy, initial education and continuous professional development in the use of ICT.

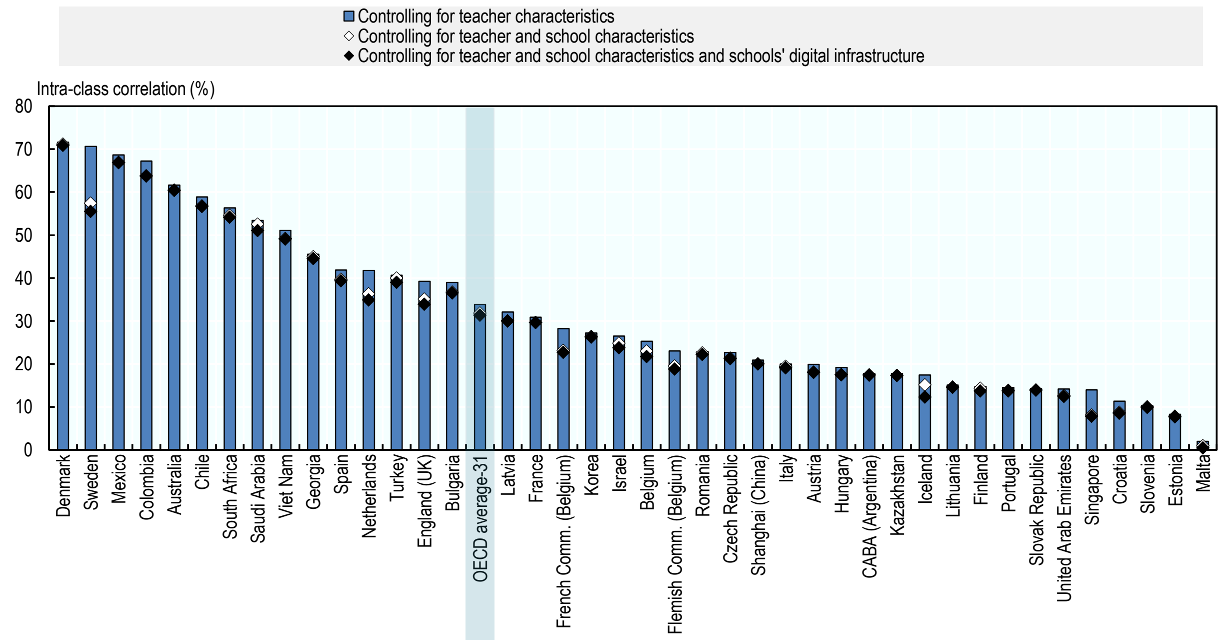
Figure 3.11 also shows that the share of the variation in teachers' use of ICT that lies between schools ranges considerably across countries and territories – from less than 10% in Estonia and Malta to more than 60% in Australia, Colombia, Denmark, Mexico and Sweden. The results for Estonia and Malta suggest that teachers' use of ICT depends mainly on teacher-level factors rather than school-level characteristics. On the contrary, high between-school variation in teachers' ICT use signals that school context (e.g. composition of student body) and school-level factors explain variations in the use of digital technology. Students in Australia, Denmark and Sweden tend to use digital technology at school more frequently than their peers in other OECD countries (OECD, 2019[14]). Thus, the high between-school variation suggests that in these countries, there are certain schools where teachers use technology for instruction less frequently than most of their colleagues working in other schools for whom the use of ICT is common practice.

TALIS data also show that in most countries and territories, school characteristics such as location, school type and student composition in terms of socio-economic and language background as well as special education needs explain little of the variation in ICT use once teacher characteristics have been taken into account (Figure 3.11). Since certain teacher characteristics are more prevalent in schools of certain types, adjusting for teacher characteristics implicitly results in taking school characteristics into account. For instance, the share of experienced teachers tends to be higher in socio-economically advantaged schools than in disadvantaged schools.

Yet, there are some exceptions to this general pattern. For instance, in Sweden the share of the overall variation in teachers' use of ICT that lies between schools decreases by 13 percentage points when also adjusting for school characteristics and not just teacher characteristics (Figure 3.11). Thus, in the case of Sweden, school characteristics such as location, school type and composition of the student body matter more for teachers' use of ICT than in other education systems. Other countries and territories where a similar pattern is observed, albeit to lesser extent (i.e. decrease of between 5 to 6 percentage points), include the French Community of Belgium, the Netherlands and Singapore.

Figure 3.11. Variation in teachers' regular use of ICT for teaching

Proportion of the overall variation in lower secondary teachers' regular use of ICT that lies between schools (intra-class correlation)



Notes: ICT refers to information and communication technology.

The proportion of the overall variation that lies between schools is calculated as 100*rho, where rho stands for the intra-class correlation. The intra-class correlation, in turn, is computed as the variation between schools, divided by the sum of the variation between schools and the variation within schools.

Controls for teacher characteristics include years of teaching experience, teachers' self-efficacy in ICT use, the inclusion of ICT use in teachers' formal training and teachers' profession development activities in ICT use.

Controls for school characteristics include school location, school type (i.e. in terms of public/private management) and student composition of schools according to socio-economic and language background, as well as special education needs.

Controls for schools' digital infrastructure include schools' resource issues, such as shortage or inadequacy of digital technology for instruction and insufficient Internet access, which hinder schools' capacity to provide quality instruction.

Cross-country comparability warrants caution, as the between-school variance estimates depend on how schools are defined and organised within countries and territories and how they are chosen for sampling purposes.

OECD average-31 excludes Alberta (Canada), Japan, New Zealand, Norway, the Russian Federation and the United States. Estimates for these countries/territories are missing due to computational process (e.g. regression coefficients are missing if there is at least one variable without valid data included in a regression model; or else in the case of non-convergence of maximum likelihood function).

Countries and territories are ranked in descending order of the proportion of the overall variation in teachers' regular use of ICT that lies between schools after controlling for teacher characteristics.

Source: OECD, TALIS 2018 Database, Table 3.16.

StatLink https://stat.link/zvisb9

As discussed previously, school's resources with respect to ICT equipment and Internet access tend to correlate with school characteristics in many education systems. The share of principals who reported that inadequate digital technology was a major impediment to good teaching tends to be higher in public schools and schools with a high concentration of disadvantaged students than in private schools and in socio-economically advantaged schools (Table 3.3). In addition, insufficient Internet access is more of an issue in schools located in rural areas, public schools and in schools with a high share of students from a disadvantaged background (Table 3.4). Thus, adjusting for schools' ICT infrastructure once teacher and school characteristics have been taken into account has limited effect on the share of the overall variation in teachers' use of ICT that lies between schools (Figure 3.11). This finding is in line with past research, which suggests that there are factors such as teacher training in ICT, collaboration among teachers, teachers' perceived self-efficacy and beliefs about teaching and the availability of educational software that matter more for teachers' actual use of ICT in the classroom than the school's ICT infrastructure (Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017[7]).

There may be other factors that explain the variation in teachers' use of ICT that lies between schools. The literature highlights the positive association between the frequency teachers use ICT in the classroom and how much they collaborate with their colleagues (Fraillon et al., 2019[15]; Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017[7]; Hatlevik and Hatlevik, 2018[31]). Collaboration can boost knowledge-sharing among teachers, including about ICT use, which in turn can translate into more frequent use of digital technology in the classroom. TALIS data also show that the more frequently teachers collaborate with their peers at school,[15] the more likely it is that they let their students use ICT for projects or class work on a regular basis (Table 3.17). This holds true in around half of the countries and territories participating in TALIS and on average across the OECD while controlling for teacher characteristics,[16] teachers' training in the use of ICT and classroom composition. This means that while digital technology fosters collaboration by providing better tools for collaborative work, collaboration among teachers itself can boost ICT use in school.

Yet, as shown by TALIS 2018 results, most of the variance in professional collaboration is at the individual (teacher) level[17] (OECD, 2020[39]). This suggests that when a teacher collaborates at school, that teacher does not collaborate with all teachers but only a few while other colleagues from the same school do not collaborate at all, hence the considerable within-school variation. This points to clusters of teachers within schools when it comes to collaboration. Policies targeting teacher collegiality and collaborative school culture can encourage teachers to collaborate instead of working in silos.

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Notes

[1] Digital skills encompass a broad range of skills, from more generic skills – such as understanding basic ICT concepts, being able to manage computer files, and using keyboards or touch-screen devices – to more specific ICT skills – like using work-related software, creating online content, evaluating online risks, framing problems in ways that computers can help solve them, and distinguishing fact from opinion. Advanced skills include coding or software development (OECD, 2019[14]).

[2] A socio-economically disadvantaged school is a school where the concentration of students from socio-economically disadvantaged homes is above 30%. A socio-economically advantaged school is a school where the concentration of students from socio-economically disadvantaged homes is 10% or less. Socio-economically disadvantaged homes are homes lacking the basic necessities or advantages of life, such as adequate housing, nutrition or medical care.

[3] A city school is a school that is located in a city with over 100 000 habitants. A rural school is a school that is located in a rural area or a village with up to 3 000 habitants.

[4] A privately managed school is a school whose principal reported that it is managed by a non-governmental organisation (e.g. a church, trade union, business or other private institution). In some countries, the privately managed schools category includes schools that receive significant funding from the government (government-dependent private schools). A publicly managed school is a school whose principal reported that it is managed by a public education authority, government agency, municipality, or governing board appointed by the government or elected by public franchise. In the principal questionnaire, this question does not make any reference to the source of the school's funding, which is reported in the preceding question.

[5] Southern Hemisphere countries were surveyed in 2017.

[6] TALIS asks school principals about the extent to which school resource issues, including the shortage or inadequacy of digital technology for instruction and insufficient Internet access, hinder their school's capacity to provide quality instruction (i.e. "not at all"; "to some extent"; "quite a bit"; or "a lot").

[7] Hereafter in this chapter, the dissimilarity index is interpreted with the assumption that school size can be adjusted. This allows the analysis to focus on the proportion of one or the other group that has to be reallocated in order to achieve a distribution of teachers from these groups that mirrors the overall population.

[8] This relationship holds while also controlling for teacher characteristics such as years of teaching experience, gender and employment status, teachers' training in the use of ICT and classroom composition.

[9] In addition to factual indicators on teachers' initial education and training, and their continuous professional development, TALIS also collects more subjective measures of teachers' perceptions of the quality of their own teaching. Namely, TALIS asks teachers about the extent to which they can do a series of goal-oriented actions – for instance, supporting students' learning through the use of digital technology (e.g. computers, tablets, smart boards) – asking them to mark one choice among four options: "not at all"; "to some extent"; "quite a bit"; "a lot".

[10] Other teacher characteristics include teachers' years of teaching experience, gender and employment status.

[11] ICT use refers to tools that can be used for projects or class work as defined in the TALIS 2018 Teacher Questionnaire. As such, it is a broadly defined concept.

[12] Other teacher characteristics include teachers' self-efficacy in ICT use, years of teaching experience, gender and employment status.

[13] TALIS asks teachers about the frequency with which they use ICT for projects and class work ("never or almost never"; "occasionally"; "frequently"; or "always").

[14] This analysis is based on logistic multilevel regression models that take into account the nested structure of the data (i.e. the fact that teachers are clustered within particular schools) while also providing estimates of the overall variance in the outcome variable that lies between and within schools.

[15] The index of professional collaboration measures teachers' engagement in deeper forms of collaboration that involve more interdependence between teachers, including teaching jointly as a team in the same class, providing feedback based on classroom observations, engaging in joint activities across different classes and age groups, and participating in collaborative professional learning.

[16] Teacher characteristics include teachers' self-efficacy in ICT use, years of teaching experience, gender and employment status.

[17] On average across the OECD, 87% of the variation in teachers' responses regarding their engagement in deeper forms of collaborative activities lies across teachers within schools, while the rest (13%) is accounted for by differences in the average level of collaboration between schools – see Table II.4.12 in *TALIS 2018 Results: Volume II* (OECD, 2020[39]).

4 Teacher allocation and learning divides

This chapter examines whether there is a link between inequalities in access to effective teachers and learning divides between socio-economically advantaged and disadvantaged students. It also tries to understand if system-level policies can promote greater equity in students' access to effective teachers. More specifically, the chapter discusses system-level relationships between the sorting of effective teachers and teaching practices, including those related to the use of digital tools, and socio-economic inequalities in student performance. It also highlights associations between the allocation of effective teachers and teaching practices, and measures of school competition and autonomy, thus hinting at the potential of policy intervention.

Highlights

- Countries and territories participating in the Teaching and Learning International Survey (TALIS) characterised by a more uneven distribution of experienced teachers tend to have lower average scores in the Programme for International Student Assessment (PISA) 2018 reading assessment. Likewise, the uneven distribution of teachers who have undergone comprehensive initial training is negatively correlated with students' mean reading score in PISA at the system level. Both points are especially true for socio-economically disadvantaged students.
- Students tend to perform worse in reading in education systems where teachers who spend a larger share of class time on actual teaching are unevenly distributed across schools. This relationship also holds for socio-economically disadvantaged students. It is important to note, however, that the findings in this report cannot be interpreted as causal. Advantaged schools might have fewer disciplinary problems, which allows teachers to spend more time on actual teaching and less on classroom management.
- Disadvantaged students tend to have just as much or more opportunity to learn digital literacy skills (such as detecting if the information read is subjective or biased) in education systems where teachers with high self-efficacy in information and communications technology (ICT) and teachers who regularly teach using ICT are more evenly distributed across schools.
- Experienced teachers are distributed more evenly across schools in countries where a higher share of principals report that their school has autonomy in appointing, hiring, dismissing or suspending teachers. In systems with more school autonomy, staffing decisions seem to take into account a wider range of factors, reducing the relative importance of seniority.

Introduction

When education systems provide equal learning opportunities to all students, differences in students' outcomes are no longer driven by factors that are outside of the control of any individual, such as socio-economic background, gender and disabilities (OECD, 2018[1]). This also implies that students who are most in need – for instance, those from socio-economically disadvantaged backgrounds – are exposed to good teachers and effective teaching practices. However, in many education systems, schools with a large portion of socio-economically disadvantaged students are precisely those that find it difficult to attract experienced teachers, who are often more effective than their junior colleagues (OECD, 2006[2]).

In today's knowledge-based economies, a poor education can have more punishing consequences: poor skills limit access to better-paying and more rewarding jobs. More generally, it limits access to better health and living conditions, and hinders social and political participation (Hanushek et al., 2015[3]; OECD, 2016[4]).

Despite significant efforts to narrow disparities in students' outcomes in the recent past, students' socio-economic background remains strongly correlated with their academic performance (OECD, 2019[5]; OECD, 2018[1]). Analyses based on PISA data show consistently that while many socio-economically disadvantaged students succeed at school, students from socio-economically advantaged family backgrounds tend to outperform their disadvantaged peers in all subjects (OECD, 2019[5]). Moreover, results from Chapters 2 and 3 of this report show that effective teachers are not distributed randomly across schools and can be concentrated in certain schools depending on school characteristics such as socio-economic profile and location. It is important to highlight here that throughout this report terms such as quality teachers, effective teachers and good teachers are used as synonyms: they all refer to teacher characteristics and teaching practices that are robustly associated with higher student proficiency, as discussed in Chapters 2 and 3.

Hence, the following questions arise: How is the sorting of good teachers and effective practices related to inequalities in student outcomes? Do socio-economic inequalities in student outcomes tend to be more moderate in education systems where good teachers are allocated more evenly across schools? Can education systems address inequalities in student outcomes by reallocating good teachers to more disadvantaged schools?

This chapter aims to answer these questions by correlating indicators of teacher allocation (from Chapters 2 and 3 of this report) with measures of inequalities in learning outcomes (as assessed by PISA).[1] The TALIS indicators of teacher allocation include the dissimilarity index, which is a commonly used measure to analyse deviation from evenness (see Box 2.1 in Chapter 2 for more detail) and the difference between disadvantaged and advantaged schools in the share of effective teachers and teachers who use effective teaching practices. The dissimilarity index assesses departure from random allocation and is, therefore, useful for seeing if teachers with certain characteristics tend to be concentrated in a restricted number of schools. However, even if the dissimilarity index shows that teachers are allocated unevenly across schools, this would not necessarily mean that a school system is inequitable. Equitable education systems may deliberately allocate more resources (including effective teachers) to disadvantaged schools – those attended by students from socio-economically disadvantaged backgrounds – as a way to compensate for less affluent parental background and hence to provide equal opportunities (OECD, 2019[5]). For this reason, the report also looks at average differences across schools in students' exposure to effective teachers and teaching practices. Strikingly, based on findings from Chapters 2 and 3, whenever there is evidence for systematic sorting of effective teachers across schools, more often than not, it goes to the benefit of schools with a high share of students from a socio-economically advantaged background.

The two angles, equality and equity, are complementary. Although the analysis looking at equality in students' access to effective teachers and teaching practices disregards the characteristics of the students, it can still identify teacher characteristics and practices along which teachers tend to sort across schools. The dissimilarity index can highlight overall imbalances in teacher allocation. On the other hand, analysis focusing on equity draws a more detailed picture of teacher allocation. Notably, it examines how teachers with certain characteristics and practices are distributed across different types of schools.

PISA-based measures of inequalities in student performance included in the analysis are the share of variance in reading performance explained by students' socio-economic profile; the difference between advantaged and disadvantaged students in reading; and the mean reading performance of students at the bottom quarter of students' socio-economic profile. This chapter highlights reading because it was the focus domain in the 2018 round of PISA, which means it was tested in more detail than the other two domains, which are mathematics and science. In addition to these indicators, TALIS measures of digital divides are also correlated with PISA-based measures of socio-economic inequalities in students' digital literacy skills.

For the analyses presented in this chapter, it is important to highlight how PISA and TALIS measure the socio-economic status of students. PISA relies on the index of economic, social and cultural status (ESCS), a composite measure that combines the financial, social, cultural and human-capital resources available to students into a single score (OECD, 2019[5]). TALIS measures students' socio-economic status by asking principals to report the share of students in their school coming from socio-economically disadvantaged homes. Throughout this report, "advantaged" schools are those in which 10% or less of the student body are reported to be socio-economically disadvantaged and "disadvantaged" schools refer to those with more than 30% of the students from socio-economically disadvantaged homes.

In addition, it should be noted that the system-level correlational analyses presented in this chapter are somewhat limited due to the potential mismatch between the lower secondary teacher population covered by TALIS and the 15-year-old student population sampled by PISA. While TALIS covers lower-secondary teachers, PISA collects information on 15-year-old students; yet, 15-year-olds are not taught by lower secondary teachers in every education system as upper secondary teachers sometimes fill this role. Moreover, it is also important to note that the findings of the system-level correlational analyses cannot be interpreted as causal.

This chapter also tries to understand if there are system-level policies that are associated with a more even and equitable sorting of teachers across schools. Namely, the chapter explores if school competition and school autonomy in hiring and dismissing teachers or determining teachers' salaries can be an effective policy lever to address inequities in teacher sorting. Although the empirical evidence on whether school competition for students is beneficial for student achievement and equity in education is mixed (Boeskens, 2016[6]; OECD, 2020[7]; OECD, 2019[8]; Urquiola, 2016[9]), competition may provide incentives for schools to improve their instructional quality, including by competing for quality teachers. Thus, among other factors, the effectiveness of school competition on student performance and equity may depend on the level of autonomy schools have to hire, dismiss and remunerate their teachers. Past research also shows that school characteristics tend to be linked to teacher quality as schools with certain characteristics may find it difficult to hire and retain high-quality teachers (Echazarra and Radinger, 2019[10]; OECD, 2018[11]). In general, schools with more challenging work environments or a higher share of socio-economically and otherwise disadvantaged students are thought to face this issue (Allen and Sims, 2018[12]; Goldhaber, Lavery and Theobald, 2015[13]; Guarino, Santibañez and Daley, 2006[14]; Johnson, Kraft and Papay, 2012[15]; Loeb, Kalogrides and Horng, 2010[16]) as do rural schools far from urban centres (Beesley and Clark, 2015[17]; Brasche and Harrington, 2012[18]; Cowen et al., 2012[19]; Downes, 2018[20]; Fowles et al., 2013[21]).

The chapter is organised as follows. First, it looks at how TALIS measures of teacher allocation relate at the system level to socio-economic inequality in student performance. The first section also explores the system-level relationships between teacher allocation in relation to digital learning and socio-economic inequality in students' digital skills. Then, the chapter examines how TALIS measures of teacher allocation relate at the system level to school competition and autonomy.

How access to effective teachers is related to socio-economic inequality in student performance

This section describes the system-level relationships between differences in students' access to effective teachers and socio-economic inequality in student performance. More specifically, it looks at the relationship between PISA-based measures of socio-economic inequalities in student performance and imbalances in the allocation of effective teachers as defined with regard to teacher characteristics and practices also discussed in Chapter 2. The distinction between teachers' characteristics and practices is that the former are somewhat fixed, portable assets that teachers always possess irrespective of the schools where they are employed. Practices are instead (at least partly) an explicit choice made by teachers teaching in a given context, and nothing ensures that they would adopt the same practices in a different school (or even with different students in the same school).

Well-trained and experienced teachers, and reading scores

At the system level, the mean reading score in PISA tends to be negatively associated with the dissimilarity index for experienced teachers (i.e. teachers with more than ten years of teaching experience) across countries and territories (linear correlation coefficient (r) = -0.44) (Table 4.1). That is, at the system level, the uneven (non-random) distribution of experienced teachers is associated with lower average reading scores. This suggests that experienced teachers are not directed to the schools that need them the most.

There is probably scope to increase average scores by relocating experienced teachers from schools where they are in surplus to schools that do not have enough of them.

As highlighted in Chapter 2, experienced teachers are more likely to work in schools with few socio-economically disadvantaged students (10% or less of the student body) than in schools where disadvantaged students constitute more than 30% of the student population in many of the countries participating in TALIS. The system-level correlation also shows that an uneven distribution of experienced teachers is negatively associated (linear correlation coefficient (r) = -0.42) with the PISA reading score of the most disadvantaged students in the country (i.e. those in the bottom quarter of the distribution of the ESCS index in the country) (Figure 4.1). This reveals a tendency for lower reading scores among disadvantaged students when experienced teachers are not evenly distributed and clustered in schools that are predominantly socio-economically advantaged.

Table 4.1. System-level relationships between TALIS measures of teacher allocation and equity in student performance

System-level correlation coefficients

			Mean reading score in PISA 2018	Percentage of variance in reading performance explained by ESCS1 (R^2)	Difference between advantaged[1] and disadvantaged students in reading	Mean reading performance at the bottom national quarter of ESCS[2]
Teacher characteristics	Experienced teachers	Dissimilarity index[4]	**-0.44**	0.22	0.04	**-0.42**
		Difference between disadvantaged and advantaged schools	-0.15	0.18	0.23	-0.20
	Teachers who had a comprehensive formal education or training[3]	Dissimilarity index[4]	**-0.36**	0.18	0.08	**-0.40**
		Difference between disadvantaged and advantaged schools	-0.05	0.09	0.18	-0.09
	Teachers in the top quarter by self-efficacy	Dissimilarity index[4]	-0.20	0.09	0.05	-0.23
		Difference between disadvantaged and advantaged schools	**-0.38**	-0.26	-0.28	-0.32
Teaching practices	Teachers in the top quarter by the frequency of use of clarity of instruction practices	Dissimilarity index[4]	-0.16	-0.16	-0.13	-0.16
		Difference between disadvantaged and advantaged schools	0.33	0.14	0.32	0.26
	Teachers in the top quarter by the frequency of use of cognitive activation practices	Dissimilarity index[4]	-0.30	-0.03	-0.02	-0.29
		Difference between disadvantaged and advantaged schools	0.14	-0.12	-0.15	0.17
	Teachers in the top quarter by class time spent on actual teaching and learning	Dissimilarity index[4]	**-0.35**	-0.07	-0.07	**-0.36**
		Difference between disadvantaged and advantaged schools	-0.27	0.10	-0.05	-0.24

Notes: System-level correlation coefficients are calculated by correlating country-level indicators that are based on TALIS and PISA data. TALIS indicators for Alberta (Canada), Ciudad Autónoma de Buenos Aires (hereafter CABA [Argentina]), England (UK) and Shanghai (China) are correlated with PISA-based measures for Canada, Argentina, the United Kingdom and the four PISA-participating provinces/municipalities of China: Beijing, Shanghai, Jiangsu and Zhejiang, respectively.

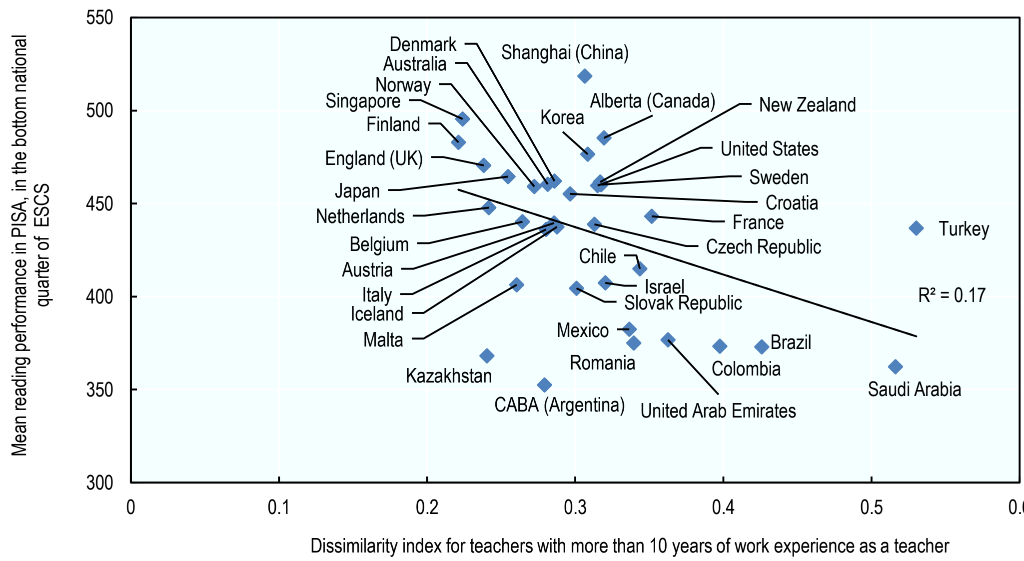
Correlation coefficients that are equal to, or lower than -0.35, or else equal to, or higher than +0.35, are highlighted.

Correlation coefficients range from -1.00 (i.e. a perfect negative linear association) to +1.00 (i.e. a perfect positive linear association). When a correlation coefficient is 0, there is no linear relationship between the two measures.

1. A socio-economically advantaged (disadvantaged) student is a student in the top (bottom) quarter of ESCS in his or her own country/territory.
2. ESCS refers to the PISA index of economic, social and cultural status.
3. Comprehensive formal education or training includes: content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting and classroom management (i.e. items a, b, c, d, e, g and i of Question 6 of the TALIS 2018 Teacher Questionnaire).
4. Restricted to countries and territories where the overall share of teachers with the specific characteristic analysed is 75% or less.

Source: TALIS 2018 database, Tables 2.3, 2.5, 2.6, 2.10, 2.8, 2.12; and OECD (2019[5]), *PISA 2018 Results (Volume II): Where All Students Can Succeed*, https://doi.org/10.1787/b5fd1b8f-en, Tables II.1 and II.B1.2.3.

Figure 4.1. Experienced teachers and students' reading performance in PISA in the national bottom quarter of socio-economic status



Notes: Linear correlation coefficient (R) =-0.42. The PISA-based indicator for Alberta (Canada), CABA (Argentina), England (UK) and Shanghai (China) refers to the values for Canada, Argentina, the United Kingdom and the four PISA-participating provinces/municipalities of China: Beijing, Shanghai, Jiangsu and Zhejiang, respectively.
The dissimilarity index measures if the allocation of teachers in a country's schools resembles the teacher population of the country. This index ranges from 0 (no segregation) to 1 (full segregation). Countries and territories where the overall share of experienced teachers is above 75% are excluded.
ESCS refers to the PISA index of economic, social and cultural status.
Source: OECD, TALIS 2018 Database, Table 2.3 and OECD (2019[5]), *PISA 2018 Results (Volume II): Where All Students Can Succeed*, https://doi.org/10.1787/b5fd1b8f-en, Table II.B1.2.3.

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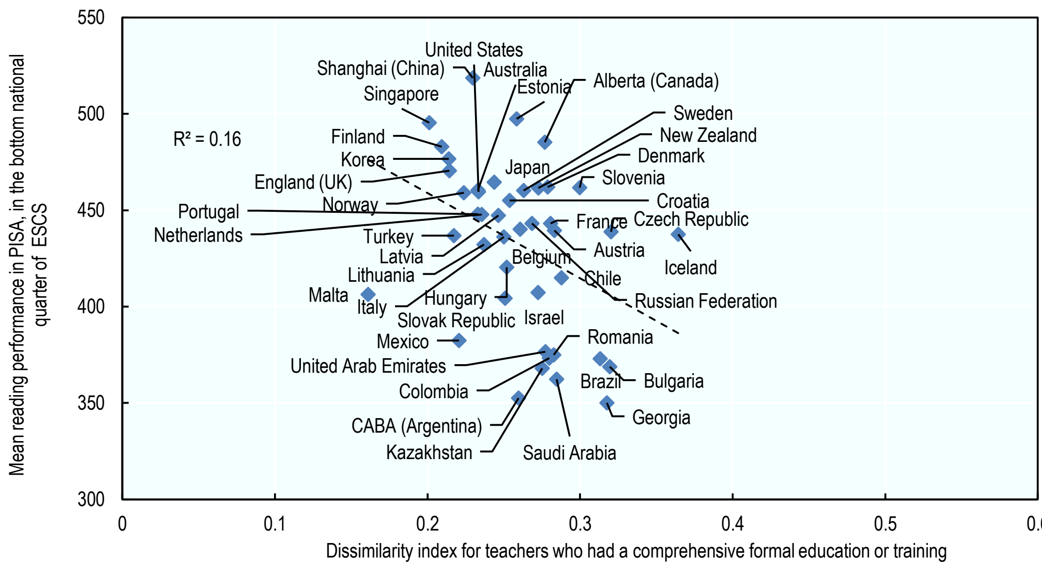
While a teacher's experience may be assumed to affect the quality of teaching they provide, the nature and scope of their training also influences what teaching they can provide and what practices they choose to adopt (OECD, 2009[22]). There is a negative association (linear correlation coefficient (r) = -0.36) between the dissimilarity index for teachers who had a comprehensive formal education or training (including pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting and classroom management) and the mean reading score as measured by PISA 2018 (Table 4.1). In other words, the more concentrated teachers with comprehensive initial training are in certain schools, the worse students tend to perform on the PISA reading test. Moreover, the system-level relationship between the allocation of teachers with comprehensive training across schools and reading performance is especially strong for the most socio-economically disadvantaged students (i.e. those at the bottom quarter by socio-economic background) (linear correlation coefficient (r) = -0.40) (Figure 4.2).

Policies can be put in place, though, to improve teaching quality in disadvantaged schools and areas. Box 4.1 provides three examples of such policies, and Box 4.2 suggests how legal reforms are a possible way to reduce inequity by evening out how good teachers are distributed, in this case in the United States.

Figure 4.2. Teachers with a comprehensive formal education and students' reading performance in the national bottom quarter of socio-economic status



Notes: Linear correlation coefficient (R) =-0.40. The PISA-based indicator for Alberta (Canada), CABA (Argentina), England (UK) and Shanghai (China) refers to the values for Canada, Argentina, the United Kingdom and the four PISA-participating provinces/municipalities of China: Beijing, Shanghai, Jiangsu and Zhejiang, respectively.

The dissimilarity index measures if the allocation of teachers in a country's schools resembles the teacher population of the country. This index ranges from 0 (no segregation) to 1 (full segregation). Countries and territories where the overall share of teachers who had a comprehensive formal education or training is above 75% are excluded.

Teachers who had a comprehensive formal education or training refer to teachers for whom content, pedagogy, classroom practice, cross-curricular skills, teaching in mixed ability setting and classroom management were included in their formal education or training.

ESCS refers to the PISA index of economic, social and cultural status.

Source: OECD, TALIS 2018 Database, Table 2.5 and OECD (2019[5]), *PISA 2018 Results (Volume II): Where All Students Can Succeed*, PISA, https://doi.org/10.1787/b5fd1b8f-en, Table II.B1.2.3.

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Box 4.1. Working to ensure high teacher quality in disadvantaged schools and areas

England (United Kingdom), Finland and Korea are three countries that combine high PISA reading scores with a low dissimilarity index for both experienced teachers and teachers who had comprehensive formal education (Figure 4.1 and Figure 4.2). This box gives a short overview of some recent policy initiatives in these countries that might have contributed to the even distribution of high-quality teachers.

In the United Kingdom, the Department for Education has identified improving the quality of teaching in challenging areas and schools as a key to more equitable education. Various monetary incentives were introduced in 2010 to train, attract and retain strong teachers in the most challenging areas. Examples include: reimbursement of student loans for teachers teaching certain subjects in short supply; retention payments for mathematics teachers in challenging areas; and a greater focus of the Teach First programme in challenging areas. In addition, GBP 30 million was dedicated to supporting disadvantaged schools with considerable recruitment and retention issues. A series of grants and premiums were also introduced to support professional development available in challenging areas, emphasising that it should be evidence-based training (Department for Education, 2017[23]).

Finland ran a large-scale project called New Comprehensive Education in 2016-19, which also addressed teacher education. As part of this, the Teacher Education Forum was created in 2016 under the auspices of the Ministry of Education and Culture to develop teacher education through co-configurative collaboration with universities and other stakeholders. The forum formulated the Teacher Education Development Programme as a plan for teachers' pre- and in-service training, involving nearly 100 representatives from teacher education, the teachers' union, local governments, researchers, principals and teachers. EUR 28 million was allocated to projects for starting the implementation of this programme. One example of a 2017 research-oriented project was the development of pedagogical studies for teachers to enhance their' competence base, especially in subject education, at the University of Helsinki. This was done through the creation of a digital database with co-operation models for pedagogical studies (Ministry of Education and Culture, Finland, 2021[24]).

An interesting aspect of teacher training in Korea is the high prevalence of online professional development. This development started in 2000 and online teacher training is currently offered by more than 20 government-authorised public and private training centres. Quality checks and co-ordination are conducted by the Korean Education and Research Information Service (KERIS), which belongs to the Ministry of Education (Minea-Pic, 2020[25]). It is possible that this wide availability of online resources and training opportunities together with central co-ordination has contributed to competence-building across the board since it minimises the negative impact of physical distances and makes it easier to interact with colleagues in other areas. By bridging differences in professional development, an even distribution of well-trained teachers is achieved.

Box 4.2. Legal reform for student equity in the United States

The United States is one of several countries that combines a high mean reading score for socio-economically disadvantaged students with low dissimilarity index value for teachers who had comprehensive training (Figure 4.2).

The federal government has carried out a series of legal reforms aimed to reduce inequity, including the No Child Left Behind Act of 2001 and the Every Student Succeeds Act of 2015. The latter is concerned with four categories of disadvantaged students: students in poverty, minorities, students who receive special education and students with limited English language skills. It stipulates for the first time the requirement for all students across the United States to be taught to the same high academic standards, with associated assessments to measure student progress toward those standards. At the same time, the law recognises the differences in circumstances between states and includes local flexibility provisions that can be applied as long as the states in question formulate comprehensive plans for achieving the law's equity goals. As such, states are granted more autonomy in designing and implementing general education standards. It also requires states to hold schools accountable in terms of achievement, including in digital learning. Importantly, it tasks states with identifying schools that struggle with achievement and formulating concrete plans to assist those schools (US Department of Education, 2015[26]).

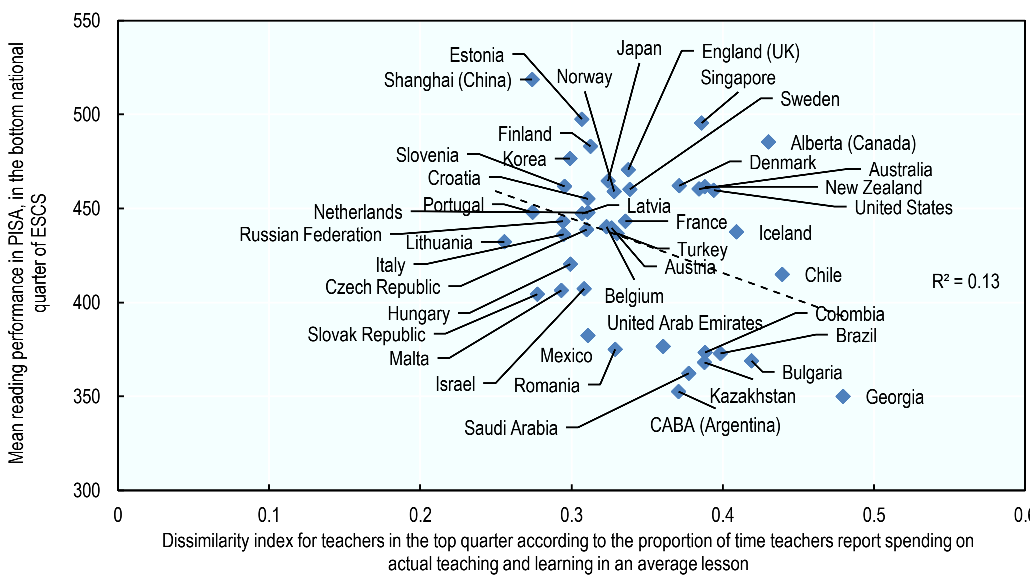
It is not only thought to have contributed to further professionalisation of teachers but also to have distributed more high-quality teachers to disadvantaged schools and areas via financial incentive (Boyd et al., 2008[27]). That said, the impact of legal reform on the federal level will necessarily be modulated by state-level legislation relating to the distribution of educational opportunities (Knight, 2019[28]). Nonetheless, this highlights the importance of legal reform to support policy implementation.

Time spent on actual teaching and reading scores

A common complaint of teachers around the world is that they have a heavy administrative burden and spend time on maintaining order in the classroom. Both hinder them from conducting actual teaching (as opposed to other work-related activities, such as lesson preparation and marking) (OECD, 2019[29]). This is important when considering that differences in time spent on actual teaching in the classroom can explain differences in student achievement in mathematics, science and reading between countries (Lavy, 2015[30]; OECD, 2021[31])

Teachers' ability to maximise instruction time is a key component of classroom management (Ainley and Carstens, 2018[32]; Kane et al., 2010[33]; Stronge et al., 2007[34]). Its effect on students' achievement, on the other hand, depends on the classroom climate, which can be partly outside of the teachers' control. On average, higher instruction time is more beneficial in classrooms with a better climate (Rivkin and Schiman, 2015[35]). Regardless of whether this ability is constrained by the teacher's own skills or by school characteristics, it is instructive to investigate how distributions of such teachers correlate with inequitable student performance.

Figure 4.3. Time spent on actual teaching and students' reading performance in PISA in the national bottom quarter of socio-economic status



Notes: Linear correlation coefficient (R) =-0.36. The PISA-based indicator for Alberta (Canada), CABA (Argentina), England (UK) and Shanghai (China) refers to the values for Canada, Argentina, the United Kingdom and the four PISA-participating provinces/municipalities of China: Beijing, Shanghai, Jiangsu and Zhejiang, respectively.

The dissimilarity index measures if the allocation of teachers in a country's schools resembles the teacher population of the country. This index ranges from 0 (no segregation) to 1 (full segregation).

ESCS refers to the PISA index of economic, social and cultural status.

Source: OECD, TALIS 2018 Database, Table 2.12 and OECD (2019[5]), *PISA 2018 Results (Volume II): Where All Students Can Succeed*, PISA, https://doi.org/10.1787/b5fd1b8f-en, Table II.B1.2.3.

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In school systems where teachers who spend more class time on actual teaching are concentrated in a limited number of schools, the mean reading score of students tends to be lower, especially for the least privileged students (Table 4.1): the dissimilarity index for teachers who are in the top quarter based on class time spent on actual teaching and learning is negatively correlated with the mean reading score of students in the bottom quarter of socio-economic status (linear correlation coefficient (r) = -0.36) (Figure 4.3). Based on the findings of Chapter 2, large and systematic differences are observed between different types of schools in the share of teachers who spend a high share of class time on instruction. Notably, teachers that spend a larger share of class time on actual teaching are more likely to work in advantaged schools as well as private schools. However, the system-level relationship does not necessarily mean that exposing disadvantaged students to such teachers will improve their performance. There might be other factors that play a part; for example, advantaged schools might have fewer disciplinary problems in the classroom overall, which allows teachers to spend more time on actual teaching instead of classroom management.

Teachers' digital self-efficacy and ICT use, and students' digital skills

TALIS measures of teacher allocation in relation to digital learning refer to differences in students' access to teachers who are trained and have high self-efficacy in ICT use and those who use ICT[2] for teaching on a regular basis. Research suggests that teaching using ICT has the potential to improve student outcomes in various ways. It can allow self-paced and individualised instruction; access to information and specialised materials well beyond what textbooks can offer; better tools for collaborative work; and project-based and inquiry-based pedagogies. ICT tools also increase students' engagement (Bulman and Fairlie, 2016[36]; OECD, 2015[37]).

Yet, evidence on how ICT use at school affects student outcomes is mixed. Past research shows that the use of ICT at school does not automatically lead to better academic results (Bulman and Fairlie, 2016[36]; OECD, 2019[38]; OECD, 2015[37]). While moderate use of ICT in schools can be beneficial (OECD, 2015[37]), frequent use of technology can have the opposite effect and may be associated with lower student performance, whether in science, mathematics or reading (OECD, 2019[38]). A recent study by Borgonovi and Pokropek (2021[39]) also shows that students with either low or high levels of ICT use tend to have lower levels of reading achievement than those with moderate use of digital technology.

Nevertheless, ICT use at school can help students acquire digital skills (Bulman and Fairlie, 2016[36]). This includes fundamental skills such as understanding basic ICT concepts; being able to manage computer files; using keyboards or touch-screen devices; using work-related software; creating online content; evaluating online risks; and distinguishing fact from opinion (OECD, 2019[38]). Analyses based on PISA data show a positive association between students' access to digital learning at school and their acquisition of digital skills (OECD, 2021[40]; OECD, 2015[37]). Importantly, those with poor acquisition of basic digital skills will find it difficult to navigate a digital world that is increasingly becoming central in everyday and work life (OECD, 2015[37]). This hits socio-economically disadvantaged students harder as they consistently appear to have lower levels of digital literacy (Karpiński, 2021[41]). Yet, past studies have also shown that access to technology is not enough to improve student learning: effective integration of technology into teaching and learning requires teachers who are well-trained and able to use digital tools for instruction (Fraillon et al., 2019[42]; OECD, 2021[40]; OECD, 2019[38]; OECD, 2015[37]). This section looks at system-level patterns of teacher distribution that relate to students' acquisition of digital skills.

Digital devices, especially those that are connected to the Internet, tend to offer more textual information and for a broader range of purposes but from different sources (OECD, 2021, p. 36[40]). Thus, reading in digital environments often requires navigating through multiple sources of text, selecting relevant information and assessing the quality of information (OECD, 2021, p. 36[40]). Multiple-source items in the PISA 2018 computer-based reading assessment, which are defined as having different authors, being published at different times or bearing different titles or reference numbers, provide a proxy measure for students' digital skills when it comes to reading in a digital environment. PISA 2018 data show that being taught in school how to detect whether information is subjective or biased is positively associated with the estimated percentage correct in the item that focuses on distinguishing facts from opinions in the PISA reading assessment (OECD, 2021[40]).

The results of the analysis presented in Table 4.2 show that in school systems where teachers in disadvantaged schools are just as likely, or even more likely, to participate in professional development in the use of ICT for teaching, students who have access at home and in school to digital learning tools have a greater advantage over those who do not (linear correlation coefficient (r) = -0.49). This could be due to the fact that teachers' proficiency in ICT yields higher returns among disadvantaged students (who are presumably less supported at home), but only to the extent that students have access to appropriate digital tools. Box 4.3 provides an example of how professional development in ICT can be organised to benefit schools across the nation.

Table 4.2. System-level relationships between TALIS measures of digital divides and equity in students' digital skills

System-level correlation coefficients

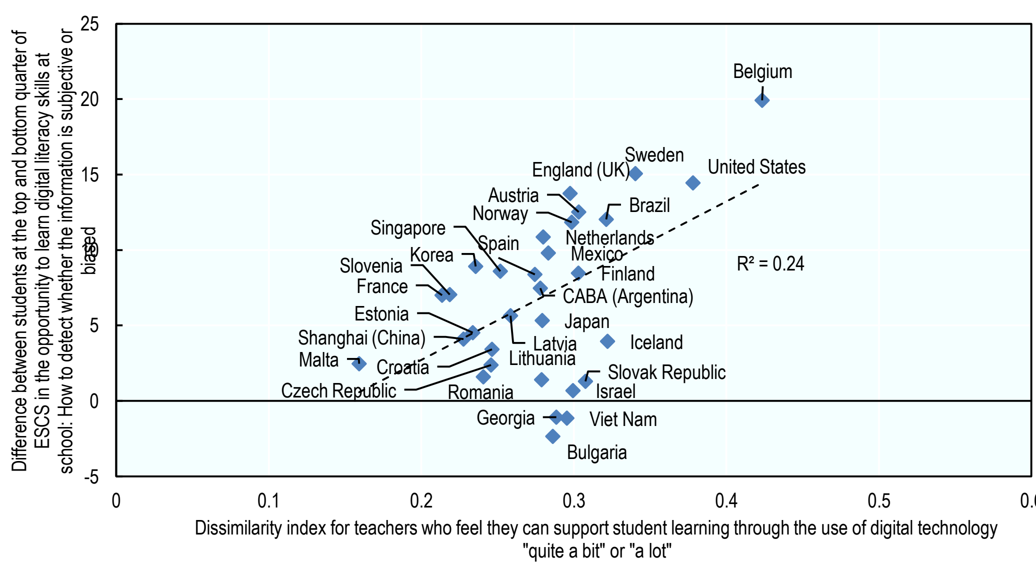
		Difference in reading multiple-source text between students who reported having limited or no access to digital learning and those who have access at home and in school (after accounting for ESCS)[1]	Difference between students at the top and bottom quarter of ESCS[1] in the opportunity to learn digital literacy skills at school, such as…		
			…how to decide whether to trust information from the Internet	…how to compare different web pages and decide what information is more relevant for schoolwork	…how to detect whether the information is subjective or biased
Teachers for whom the use of ICT for teaching was included in their formal education or training	Dissimilarity index[3]	0.23	0.21	0.17	0.07
	Difference between disadvantaged and advantaged schools	0.02	0.14	0.08	0.20
Teachers for whom ICT skills for teaching were included in their professional development activities	Dissimilarity index[3]	-0.10	0.28	0.24	0.34
	Difference between disadvantaged and advantaged schools	**-0.49**	0.03	-0.04	-0.12
Teachers who feel they can support student learning through the use of digital technology "quite a bit" or "a lot"	Dissimilarity index[3]	0.34	0.29	-0.24	**0.49**
	Difference between disadvantaged and advantaged schools	0.06	-0.25	-0.28	-0.32
Teachers who "frequently" or "always" let students use ICT for projects or class work	Dissimilarity index[3]	0.33	0.33	0.33	**0.45**
	Difference between disadvantaged and advantaged schools	0.17	-0.13	-0.04	0.12

Notes: System-level correlation coefficients are calculated by correlating country-level indicators that are based on TALIS and PISA data. TALIS indicators for Alberta (Canada), CABA (Argentina), England (UK) and Shanghai (China) are correlated with PISA-based measures for Canada, Argentina, the United Kingdom and the four PISA-participating provinces/municipalities of China: Beijing, Shanghai, Jiangsu and Zhejiang, respectively.
Correlation coefficients that are equal to, or lower than -0.35, or else equal to, or higher than +0.35, are highlighted.
Correlation coefficients range from -1.00 (i.e. a perfect negative linear association) to +1.00 (i.e. a perfect positive linear association). When a correlation coefficient is 0, there is no linear relationship between the two measures.
1. ESCS refers to the PISA index of economic, social and cultural status.
2. A socio-economically advantaged (disadvantaged) student is a student in the top (bottom) quarter of ESCS in his or her own country/territory.
3. Restricted to countries and territories where the overall share of teachers with the specific characteristic analysed is 75% or less.
Source: TALIS 2018 database, Tables 3.5, 3.7, 3.12, 3.15; and OECD (2021[40]), *21st-Century Readers: Developing Literacy Skills in a Digital World*, https://doi.org/10.1787/a83d84cb-en, Tables B.2.5 and B.2.6.

Another teacher characteristic that is worth examining is digital self-efficacy. Self-efficacy is the perception of one's own capacity to perform a specific task well. It is separate from self-confidence, which is a more general trait (Ainley and Carstens, 2018[32]). In this case, it is the confidence to use ICT in teaching. At the system level, teacher allocation across schools based on their self-efficacy in ICT and their actual use of digital technology in the classroom are weakly correlated with students' skills in navigating through multiple-source text, selecting relevant information and assessing the quality of information (Table 4.2). Yet, the dissimilarity index for teachers with high self-efficacy in the use of ICT is positively correlated with the difference between the most and the least advantaged students in terms of opportunity to learn digital literacy skills at school. Detecting if information is subjective or biased (linear correlation coefficients (r) = 0.49) is one aspect of these skills (Figure 4.4). As highlighted in Chapter 3, the share of teachers who feel they can support student learning through the use of digital technology and also of those who use ICT for instruction on a regular basis is larger in private than in public schools in almost a quarter of countries and territories participating in TALIS.

Distributing teachers who have high ICT self-efficacy more evenly among schools may help provide disadvantaged students with the same opportunity to learn digital literacy skills as their peers from socio-economically advantaged families. Teachers who feel that they can support student learning through the use of digital technology tend to be more motivated and able to offer such opportunity. Together with the general availability of adequate digital infrastructure, access to teachers with high ICT self-efficacy can increase engagement in digital learning of both advantaged and disadvantaged students.

Figure 4.4. Teachers' self-efficacy in the use of ICT and students' opportunity to learn digital literacy skills at school



Notes: Linear correlation coefficient (R) =-0.49. The PISA-based indicator for CABA (Argentina), England (UK) and Shanghai (China) refers to the values for Argentina, the United Kingdom and the four PISA-participating provinces/municipalities of China: Beijing, Shanghai, Jiangsu and Zhejiang, respectively.

The dissimilarity index measures if the allocation of teachers in a country's schools resembles the teacher population of the country. This index ranges from 0 (no segregation) to 1 (full segregation). Countries and territories where the overall share of teachers who feel they can support student learning through the use of digital technology "quite a bit" or "a lot" is above 75% are excluded.

ESCS refers to the PISA index of economic, social and cultural status.

ICT refers to information and communication technology.

Source: OECD, TALIS 2018 Database, Table 3.12 and OECD (2021[40]), *21st-Century Readers: Developing Literacy Skills in a Digital World*, https://doi.org/10.1787/a83d84cb-en, Table B.2.5.

StatLink https://stat.link/u4ykem

A more even allocation of teachers who use ICT for teaching on a regular basis is positively associated with the difference between the most and the least advantaged students in having the opportunity to learn how to detect whether information is subjective or biased (linear correlation coefficients (r) = 0.45) (Table 4.2). That is, disadvantaged students tend to have just as much or more opportunity to learn such digital skills in countries where teachers who "frequently" or "always" use ICT for instruction are more evenly distributed across schools.

Box 4.3. Teacher professional development in ICT in Estonia

Estonia achieves high PISA reading scores and, as shown above, stands out as the only country where students who report having little or no access to digital learning perform better in reading multiple-source texts. Estonia employs comprehensive national strategies for ICT use in schools, for example, as part of the Estonia Lifelong Learning Strategy 2020. This was launched in 2014 and its central goal is to incorporate "digital culture" at every school level (Ministry of Education and Research, Republic of Estonia, 2015[43]). According to the European Commission's 2nd Survey of Schools: ICT in Education, Estonia is one of Europe's top countries when it comes to teacher involvement in ICT learning, both during their own time and as provided by their schools, ranking first (90%) and second (79%) respectively at lower secondary level (data.europa.eu, 2019[44]). In particular, ICT training is largely provided to teachers through HITSA (*Hariduse Infotehnoloogia Sihtasutus*), which is a non-profit organisation jointly established by the Estonian national government, the University of Tartu and Tallinn University. It aims to foster educational leaders in a digital age by helping teachers to conduct goal-oriented teaching using ICT. It also formulates visions and action plans that incorporate digital tools (European Schoolnet, 2015[45]).

How access to effective teachers is related to school competition and autonomy

This section is concerned with the relationship between system-level characteristics and policies, and the allocation of effective teachers and teaching practices. In particular, the focus will be on the degree of autonomy that schools enjoy, and on the degree of competition they face. Both aspects are likely to have an impact on the management of human resources in schools, in particular the hiring, training and firing of teachers.

The TALIS 2018 Principal Questionnaire includes questions on how many schools are competing for the same students and to what degree principals feel that their school has autonomy over the appointment or hiring of teachers; dismissal or suspension of teachers; and determining teachers' salaries. In TALIS 2018, "autonomous" means that significant responsibility is taken solely by a principal, other members of the school management team or teachers not part of the school management team (OECD, 2020[46]).

There is no theoretical reason to expect that the relationship between equity and school competition goes in one direction or another. Policies that increase school choices may allow disadvantaged students to opt for high-performing schools outside of their immediate neighbourhoods. But it can also allow schools to select only the best students (Boeskens, 2016[6]; OECD, 2020[7]; OECD, 2019[8]; Urquiola, 2016[9]). At the same time, competition among schools has the potential to incentivise them to hire and retain better teachers as long as they have the autonomy to do so. Policy reviews have noted that school autonomy for staff-related tasks can help avoid misallocations and can better match staff profiles to the needs of the school. However, an increase in autonomy entails recruitment and management costs that may lead to greater disparities in staff qualifications among schools (OECD, 2020[46]).

Importantly, the reduction in misallocation can occur in ways that are difficult to observe, such as the ability of teachers to work with a particular type of students. Reducing misallocation along these unobservable –

but relevant – dimensions can go hand in hand with an increase in imbalances in other dimensions that are easier to observe but maybe less relevant. As such, while it is reasonable to expect less misallocation in systems with greater school autonomy, that same autonomy may lead to more imbalances between schools as teachers opt for schools with certain characteristics more than others. However, countries that increase autonomy can also, at the same time, put in place compensatory mechanisms to help high-need schools attract and retain good teachers: this is one way to interpret results from PISA showing that increased autonomy in staffing practices is not necessarily associated with more inequality (OECD, 2018[11]). Moreover, past findings also suggest that school autonomy is positively associated with greater equity in student performance if it is accompanied by higher levels of accountability (OECD, 2018[11]; OECD, 2016[47]; Torres, 2021[48]).

This section explores associations between school competition and autonomy, and students' access to effective teachers and teaching practices to see if relevant school management policy measures could potentially facilitate more equitable learning on the system level.

According to system-level correlational analysis, the association between school competition and school autonomy in hiring, dismissing and determining teachers' salaries and TALIS measures of teacher allocation is weak. As shown in Table 4.3, in general, there is hardly any correlation between indicators of school competition and autonomy, and the allocation of teachers, based on neither their characteristics nor the practices they use. The only exception to this pattern is the sorting of experienced teachers across schools. One possible reason for this exception is that, in systems that are very centralised and where schools have little autonomy, experience is one of the main criteria used to allocate teachers (seniority-based system). In these systems, more experienced teachers are able, after many years of career, to move to more desirable schools such as advantaged and urban schools. On the other hand, systems with more school autonomy might have more diversity in terms of teacher characteristics because a wider range of criteria is taken into account in the hiring process. The decentralisation of hiring can allow assessment of a wider range of candidates' characteristics, thus reducing the relative importance of other elements like experience. This is precisely one way more autonomy can reduce misallocations. This would explain why experienced teachers are distributed differently between systems with high and low school autonomy.

Across TALIS participants, the higher the share of principals within a country who report that their school has autonomy in appointing or hiring teachers, the more evenly experienced teachers tend to be distributed across schools (linear correlation coefficient (r) = -0.51) (Figure 4.5). Differences in the share of principals within a country who report that their school has autonomy in appointing or hiring teachers account for 26% of the differences in the dissimilarity index for experienced teachers. Similarly, the higher the share of principals within a country who report that their school has autonomy in dismissing or suspending teachers from employment, the more evenly experienced teachers tend to be distributed across schools (linear correlation coefficient (r) = -0.47) (Table 4.3). These findings suggest that higher school autonomy in staffing practices can result in a more equal distribution of teachers across schools. Past research has found that higher levels of school autonomy in managing teachers tend to produce a more equitable sorting of teachers across schools (OECD, 2018[11]). Yet, disadvantaged schools may need monetary or other support to be able to attract and retain the teachers they want (OECD, 2018[11]).

Box 4.4 points to the examples of Brazil, China, Turkey and Japan to illustrate how various incentives as well as mandatory teacher allocation policies can be used to achieve different outcomes in teacher distribution.

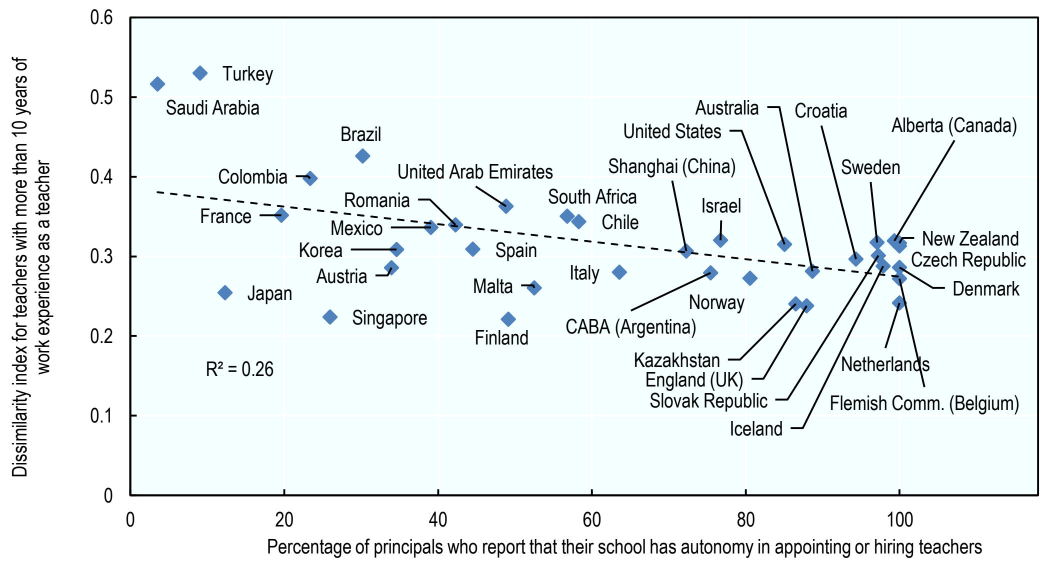
Table 4.3. System-level relationships between TALIS measures of teacher allocation, and school competition and autonomy

System-level correlation coefficients

			Percentage of principals who report that two or more other schools compete for students in their school's area	Percentage of principals who report that their school has autonomy in…			
				…appointing or hiring teachers	…dismissing or suspending teachers from employment	…establishing teachers' starting salaries	…determining teachers' salary increases
Teacher characteristics	Experienced teachers	Dissimilarity index[1]	-0.28	**-0.51**	**-0.47**	-0.21	-0.17
		Difference between disadvantaged and advantaged schools	0.06	-0.04	-0.08	0.01	0.00
	Teachers who had a comprehensive formal education or training	Dissimilarity index[1]	-0.23	0.19	0.21	0.02	0.03
		Difference between disadvantaged and advantaged schools	-0.10	-0.01	-0.10	-0.09	-0.07
	Teachers in the top quarter by self-efficacy	Dissimilarity index	-0.04	0.27	0.20	0.21	0.29
		Difference between disadvantaged and advantaged schools	0.23	-0.14	-0.22	-0.07	-0.06
Teaching practices	Teachers in the top quarter by the frequency of use of clarity of instruction practices	Dissimilarity index	-0.20	0.25	0.24	0.33	**0.37**
		Difference between disadvantaged and advantaged schools	0.23	0.28	0.19	0.12	0.19
	Teachers in the top quarter by the frequency of use of cognitive activation practices	Dissimilarity index	-0.07	0.12	0.08	0.28	0.33
		Difference between disadvantaged and advantaged schools	0.23	0.01	-0.01	0.23	0.23
	Teachers in the top quarter by class time spent on actual teaching and learning	Dissimilarity index	-0.14	-0.05	-0.08	0.00	0.10
		Difference between disadvantaged and advantaged schools	0.23	-0.32	-0.21	-0.13	-0.25

Notes: System-level correlation coefficients are calculated by correlating country-level indicators that are based on TALIS and PISA data. Correlation coefficients that are equal to, or lower than -0.35, or else equal to, or higher than +0.35, are highlighted.
Correlation coefficients range from -1.00 (i.e. a perfect negative linear association) to +1.00 (i.e. a perfect positive linear association). When a correlation coefficient is 0, there is no linear relationship between the two measures.
1. Restricted to countries and territories where the overall share of teachers with the specific characteristic analysed is 75% or less.
Source: TALIS 2018 database, Tables 2.3, 2.5, 2.6, 2.10, 2.8, 2.12; and OECD (2020[46]), *TALIS 2018 Results (Volume II): Teachers and School Leaders as Valued Professionals*, https://doi.org/10.1787/19cf08df-en, Table II.5.1.

Figure 4.5. Experienced teachers and school autonomy in appointing or hiring teachers



Notes: Linear correlation coefficient (R) =-0.51.

The dissimilarity index measures if the allocation of teachers in a country's schools resembles the teacher population of the country. This index ranges from 0 (no segregation) to 1 (full segregation). Countries and territories where the overall share of experienced teachers is above 75% are excluded.

Source: OECD, TALIS 2018 Database, Table 2.3 and OECD (2020[46]), *TALIS 2018 Results (Volume II): Teachers and School Leaders as Valued Professionals*, https://doi.org/10.1787/19cf08df-en, Table II.5.1.

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Box 4.4. Incentives to attract quality teachers and mandatory teacher transfers

Incentive-based policies

In a fairly unregulated teacher labour market, it is possible to introduce various incentives to try to attract good teachers to disadvantaged schools that find it difficult to hire and retain such teachers due to factors like disruptive learning environments, negative reputation, and geographical remoteness. The following are a few examples of incentive-based policies.

In São Paulo state, Brazil, the government has implemented what is known as the ALE (*Adicional por Local de Exercício*) programme since 2008 (Secretaria de Orçamento e Gestão, Governo do Estado de São Paulo, 2018[49]). As part of this, salary premiums between 24% and 36% of the base salary are offered to teachers working in disadvantaged schools. Disadvantaged schools are categorised as being located either in rural areas or in socially vulnerable areas peripheral to a large urban centre. This measure has been found to reduce teacher turnover by 8.3 percentage points in public schools in São Paulo (Camelo and Ponczek, 2021[50]).

In China, career-related incentives are used to attract teachers to remote areas. The Special Teaching Post Plan for Rural Schools was initiated in 2006 and is based on the recruitment of university graduates to remote areas in central and western China with large minority populations and socio-economic disadvantage. The contract is for three years, after which the teachers are asked to take a test. Those who qualify are then given the opportunity to stay and take up a tenure track position. In 2015, around 90% of the teachers who finished the three-year period stayed in their schools (OECD, 2016[51]).

Mandatory teacher transfers

An alternative approach to the above is to control teacher allocation and teacher transfers centrally. Although this space is not sufficient to properly discuss the topic, involuntary transfers of teachers between schools that have different characteristics has the potential of serving as a tool with the specific aim of reducing inequities. Here, involuntary simply means that there are institutional mechanisms in place that either assign teachers to workplaces or prevent them from remaining in one school for a longer period of time. Although data are scarce, there are indications such as those from an American county that if principals in disadvantaged schools are allowed to guide transfers of low-performing teachers to more advantaged schools, the teachers that replace them will often perform better when measuring factors like work absence and value added to students' achievement in mathematics and reading (Grissom, 2014[52]). Still, more research is needed before definite conclusions can be drawn. Nonetheless, it is useful to note this potential when considering the examples of Turkey as well as Japan below, contrasting them with approaches that depend more on the forces of an open teacher labour market.

Interestingly, while both Turkey and Japan have one of the lowest percentages of principals who reported autonomy in teacher appointments, Turkey displays a high dissimilarity index for experienced teachers, unlike Japan that does not (Figure 4.6).

The Turkish school system is highly centralised in terms of decision making and is markedly bigger in size than other similarly centralised systems in Europe like Greece and Luxembourg. Likewise, Turkey has a highly centralised system of teacher allocation based on initial assignments of new teachers and seniority-based transfers (Kitchen et al., 2019[53]). This means that teachers are assigned to schools by the Turkish Ministry of National Education (MoNe) early in their career but then gain increasing freedom to transfer to schools as they wish when they accrue points in a seniority score system. In addition to this, the system employs various incentives to make more remote and undeveloped regions attractive such as higher gains in seniority score by working in those areas (Ozoglu, 2015[54]).

In 2015, Turkey introduced a new probation appraisal and induction programme for trainee teachers. As part of this, they are assigned to a school where they conduct practical work and have a supervisor who mentors them during this period (Kitchen et al., 2019[53]). This is meant to give them better preparation before they become certified teachers as their initial assignments by MoNe will often be rural, disadvantaged schools that can be challenging for novice teachers.

Japan is an OECD high-achiever in PISA reading. It also has fairly high mean reading performance for most disadvantaged students combined with a low dissimilarity index of experienced teachers (Figure 4.1). Among the countries with a low percentage who reported school competition over students, Japan has the highest difference between disadvantaged and advantaged schools in how many self-efficacy teachers they have (Figure 4.6).

Somewhat similar to Turkey, Japan uses a mandatory mobility scheme where teachers hired on the prefectural level are regularly assigned to new schools across municipalities in the same prefecture, which has the effect of regular high turnover. The stated aims of this policy include balancing attributes like age and gender in the teacher populations of schools, giving teachers varied professional experience and achieving a more equal spread of educational quality. The system is not uniform across Japan, however, as prefectural and municipal boards of education work together and allocate responsibilities in a variety of ways with different rules as to how often teachers should be transferred and according to what criteria. For example, in Iwate prefecture teachers are transferred after having worked in a remote area for three years, and in Osaka prefecture principals can initiate a process to retain teachers for more than ten years (Numano, 2017[55]).

In a system such as this, high turnover can have an equalising effect if transfers are random in the sense that the distribution of various teacher characteristics can become even. If, however, the transfers are guided by set criteria, the same measures can enhance equity by ensuring that useful teacher characteristics benefit schools and areas that need them the most. Of course, this is based on the assumption that criteria and transfer mechanisms are fine-tuned enough to achieve the desired outcomes.

Other associations of note are those between schools' autonomy in determining teachers' salary increases and dissimilarity indices for teachers who frequently use practices relating to clarity of instruction (linear correlation coefficient (r) = 0.37) (Table 4.3). The pattern here is, in a way, opposite to the above finding about the distribution of experienced teachers. But, as discussed previously, a high dissimilarity index can also reflect a deliberate policy of supporting schools that are most in need. Clarity of instruction is also a typical example of something that is difficult to observe. Only schools that have higher autonomy would be able to identify teachers that engage in these practices and reward them. So, school autonomy with regard to salary setting can act as a powerful tool for disadvantaged schools, who can attract teachers who frequently use these practices. However, such policy would likely require monetary support for disadvantaged schools so that they can pay higher salaries.

In general, there is no strong correlation between system-level policies such as school competition and school autonomy in hiring; dismissing and determining teachers' salaries; and the sorting of teachers who are trained in and feel capable of using ICT or who teach using digital technology. Yet, the system-level correlational analysis suggests that the higher the share of schools within a country that has autonomy in appointing and hiring teachers, the greater the concentration of teachers whose professional development included ICT skills for teaching (linear correlation coefficient (r) = 0.41) (Table 4.4). The analysis also shows that differences between disadvantaged and advantaged schools in terms of the share of teachers whose professional development included ICT skills for teaching is negatively correlated with the share of principals who reported having the autonomy to set teachers' starting salaries and to increase teacher salaries (linear correlation coefficients (r) = -0.46 and -0.37, respectively) (Table 4.4). These correlations indicate that education systems where schools have more autonomy in hiring may have a more uneven distribution of teachers who receive in-service training in ICT use, with these teachers going to more advantaged schools – at least when the autonomy has to do with salary setting.

Table 4.4. System-level relationships between TALIS measures of digital divides, and school competition and autonomy

System-level correlation coefficients

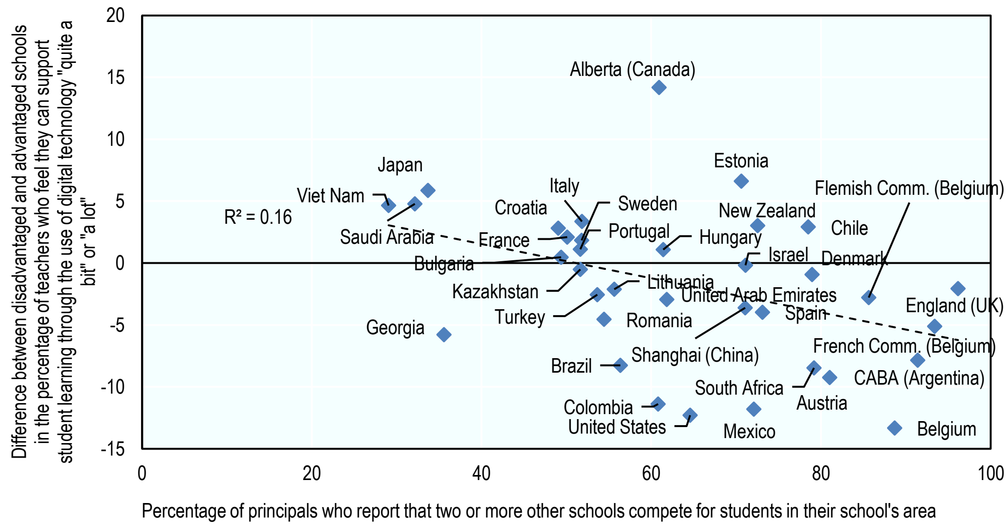
		Percentage of principals who report that two or more other schools compete for students in their school's area	Percentage of principals who report that their school has autonomy in…			
			…appointing or hiring teachers	…dismissing or suspending teachers from employment	…establishing teachers' starting salaries	…determining teachers' salary increases
Teachers for whom the use of ICT for teaching was included in their formal education or training	Dissimilarity index[1]	-0.15	-0.17	-0.13	-0.10	-0.04
	Difference between disadvantaged and advantaged schools	-0.08	0.26	0.28	0.28	0.32
	Dissimilarity index[1]	-0.13	**0.41**	0.31	0.11	0.18

		Percentage of principals who report that two or more other schools compete for students in their school's area	Percentage of principals who report that their school has autonomy in…			
			…appointing or hiring teachers	…dismissing or suspending teachers from employment	…establishing teachers' starting salaries	…determining teachers' salary increases
Teachers for whom ICT skills for teaching were included in their professional development activities	Difference between disadvantaged and advantaged schools	-0.13	-0.19	-0.19	**-0.46**	**-0.37**
	Dissimilarity index[1]	0.06	0.20	0.07	0.14	0.24
Teachers who feel they can support student learning through the use of digital technology "quite a bit" or "a lot"	Difference between disadvantaged and advantaged schools	**-0.40**	0.17	0.15	0.06	0.11
	Dissimilarity index[1]	-0.07	-0.03	-0.09	0.11	0.27
Teachers who "frequently" or "always" let students use ICT for projects or class work	Difference between disadvantaged and advantaged schools	0.22	0.28	0.25	-0.12	-0.15

Notes: System-level correlation coefficients are calculated by correlating country-level indicators that are based on TALIS and PISA data. Correlation coefficients that are equal to, or lower than -0.35, or else equal to, or higher than +0.35, are highlighted.
Correlation coefficients range from -1.00 (i.e. a perfect negative linear association) to +1.00 (i.e. a perfect positive linear association). When a correlation coefficient is 0, there is no linear relationship between the two measures.
1. Restricted to countries and territories where the overall share of teachers with the specific characteristic analysed is 75% or less.
Source: TALIS 2018 database, Tables 3.5, 3.7, 3.12, 3.15; and OECD (2020[46]), *TALIS 2018 Results (Volume II): Teachers and School Leaders as Valued Professionals*, https://doi.org/10.1787/19cf08df-en, Table II.5.1.

The system-level analysis also shows that differences between disadvantaged and advantaged schools in terms of the share of teachers with high self-efficacy in ICT use is negatively correlated with the share of principals who reported that two or more schools in their district were competing for their students (linear correlation coefficient (r) = -0.40) (Figure 4.6). Thus, in education systems where there is more competition for students among schools, teachers who are self-efficacious in the use of digital technologies tend to sort into advantaged schools. The empirical evidence on the effect of school competition on teacher quality is mixed. There are studies showing that "more competition can increase teacher quality, particularly for schools serving predominantly lower-income students" (Hanushek and Rivkin, 2003[56]). This may be the case if competition enhances the productivity of disadvantaged schools more than it benefits advantaged schools. Competition can provide incentives for considerable improvements in disadvantaged schools' hiring, retention, monitoring and other teacher management practices. However, increased competition across schools can also result in more disparities in teacher quality, in favour of socio-economically advantaged schools. In general, these schools are assumed to be more effective in attracting and retaining good teachers. Yet, as with all other findings presented in this chapter, one should be cautious in interpreting the results, which are only correlational and not causal. The observed system-level correlation between school competition and the differences in the share of teachers with high self-efficacy in ICT use between disadvantaged and advantaged schools may be a result of mediating factors. For example, in education systems where school competition is common, the gap in the quality of ICT infrastructure between advantaged and disadvantaged schools may be larger, which, in turn, is related to differences in teachers' self-efficacy in ICT use between disadvantaged and advantaged schools. Results from Chapter 3 show that, on average across the OECD, the share of teachers with high self-efficacy in ICT use is higher in schools where the quality of instruction is not hindered by a shortage or inadequacy of digital technology, or insufficient Internet access (Table 3.1).

Figure 4.6. Teachers' self-efficacy in the use of ICT and school competition for students



Notes: Linear correlation coefficient (R) =-0.40.
Disadvantaged schools refer to schools with more than 30% of students from socio-economically disadvantaged homes. Advantaged schools refer to schools with less than or equal 10% of students from socio-economically disadvantaged homes.
ICT refers to information and communication technology.
Source: OECD, TALIS 2018 Database, Table 3.12.

StatLink https://stat.link/zyubnd

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Notes

[1] The system-level correlational analyses presented in this chapter include correlations of country-level indicators that are based on TALIS and PISA data.

[2] ICT refers to tools that can be used for projects or class work as defined in the TALIS 2018 Teacher Questionnaire, which makes it a broad concept.

Annex A. Technical notes on TALIS 2018

The objective of the Teaching and Learning International Survey (TALIS) in 2018 was to obtain, in each participating country or territory, a representative sample of teachers for each International Standard Classification of Education (ISCED) level in which the country or territory participated. TALIS 2018 identified policy issues that encompass the classroom, teachers, schools and school management, so the coverage of TALIS 2018 extends to all teachers of each concerned ISCED level and to the principals of the schools where they teach. The international sampling plan prepared for TALIS 2018 used a stratified two-stage probability sampling design. This means that teachers (second-stage units, or secondary sampling units) were to be randomly selected from the list of in-scope teachers in each of the randomly selected schools (first-stage units, or primary sampling units). A more detailed description of the survey design and its implementation can be found in the *TALIS 2018 Technical Report* (OECD, 2019[1]).

A teacher of ISCED level 1, 2 or 3 is one who, as part of his or her regular duties in their school, provides instruction in programmes at that ISCED level. Teachers who teach a mixture of programmes at different ISCED levels in the target school are included in the TALIS universe. There is no minimum cut-off for how much teaching these teachers need to be engaged in at any of the three ISCED levels.

The international target population of TALIS 2018 restricts the survey to those teachers who teach regular classes in ordinary schools and to the principals of those schools. Teachers teaching adults and teachers working in schools exclusively devoted to children with special needs are not part of the international target population and are deemed out of scope. Unlike in TALIS 2008, however, teachers working with special needs students in a regular school setting were considered in scope in TALIS 2013 and 2018. When a school is made up exclusively of these teachers, the school itself is said to be out of scope. Teacher aides, pedagogical support staff (e.g. guidance counsellors and librarians) and health and social support staff (e.g. doctors, nurses, psychiatrists, psychologists, occupational therapists and social workers) were not considered to be teachers and, thus, not part of the TALIS international target population.

For national reasons, participating countries/territories could choose to restrict the coverage of their national implementation of TALIS 2018 to parts of the country. For example, a province or state experiencing civil unrest or in an area struck by a natural disaster could be removed from the international target population to create a national target population that does not include these provinces, states or areas. Participating countries were invited to keep these exclusions to a minimum by keeping the national survey population to at least 95% of the teachers.

TALIS 2018 recognised that attempting to survey teachers in very small schools can be inefficient and difficult. For each ISCED level, surveying teachers in schools with no more than three teachers at a specific ISCED level and those teaching in schools located in geographically remote areas could be a costly, time-consuming and statistically inefficient exercise. Therefore, participating countries were allowed to exclude those teachers for TALIS 2018 data collection, thus creating a national survey population different from the national target population. The national project manager (NPM) for each country/territory was required to document the reasons for exclusion, the size, the location, the clientele, etc., of each excluded school. This documentation was required for each ISCED level in which a country/territory participated.

Within a selected in-scope school, the following categories of teachers were excluded from the sample:

- teachers teaching in schools exclusively serving special needs students
- teachers who also act as school principals: no teacher data collected, but school principal data collected
- substitute, emergency or occasional teachers
- teachers on long-term leave
- teachers teaching exclusively adults
- teachers who had taken part in the TALIS 2018 field trial.

Sample size requirements

For each ISCED level, the same requirements for sample size and precision of estimates were established. To allow for reliable estimation and modelling, while allowing for some amount of non-response, the minimum sample size was set at 20 teachers within each participating school. A minimum sample of 200 schools was to be drawn from the population of in-scope schools. Thus, the nominal international sample size was a minimum of 4 000 teachers for each ISCED level in which a country or territory participated. Participating countries and territories could choose to augment their national sample by selecting more schools, by selecting more teachers within each selected school or by increasing both. Some countries and territories were asked to increase the within-school sample to counterbalance the effect of selecting too many schools with fewer than 20 teachers. The sample size requirement was reduced for some participating countries and territories because of the smaller number of schools available for sampling. In a few cases, because the average number of teachers in the schools was fewer than expected in the international plan, the number of schools sampled was increased to maintain a minimum total number of participating teachers.

In many countries/territories, the separation of grades in ISCED levels does not correspond to a physical separation of school buildings or administrations: schools that offer grades 8 to 12 straddle ISCED levels 2 and 3, but all of ISCED level 2 would not be covered by those schools. Arrangements were made with the NPM and their team to optimise the selection of the school sample either by minimising the overlap of the respective samples (one school is selected for participation in only one ISCED level) or maximising the sample overlap (a selected school contributes to all concerned ISCED levels). However, in the case of maximised overlap, teachers who taught at more than one level would be asked to participate in only one.

Definition of teachers

As in previous cycles, TALIS 2018 followed the INES (Indicators of Educational Systems) data collection definition of a teacher for sampling and analysis: “A classroom teacher (ISCED 0-4) is defined as a person who plans, organises and conducts a group of activities with the aim of developing students’ knowledge, skills and competencies as stipulated by educational programmes.” (OECD, 2018, p. 43[2]).

Adjudication process

The basic principle that guides the adjudication is to determine, for each participating country or territory and for each of the TALIS options, whether the data released to the countries and territories are fit to provide policy relevant, robust international indicators and analysis on teachers and teaching in a timely and cost effective manner.

To establish fitness for use, a number of quality assurance processes were designed and activated throughout the survey process. Some processes relied on expert advice and opinion; some relied on qualitative information and learned judgement; some relied on quantitative information. For more detailed information, please refer to the *TALIS 2018 Technical Report* (OECD, 2019[1]).

During the adjudication session, each individual dataset – that is, the combination of participating countries/territories, survey options and questionnaire types – was submitted to the same examination. For the first time in a TALIS cycle, principal data were evaluated on their own. In other words, principal and teacher data received separate adjudication evaluations per TALIS option and per country/territory.

The issues evaluated concerned the questionnaire adaptation to national context, translation and verification, quality of the sampling frame, handling of out-of-scope and refusal units (i.e. teachers and/or schools), within-school sampling, data collection, data cleaning, the reports of quality observers, participation rates and overall compliance with the technical standards. Once each survey process had been assessed, a recommended rating was formulated, accounting for the participation rates, and for any unresolved issues.

The adjudication rules, based on participation rates for principals and teachers, are displayed in Table A A.1 and Table A A.2. An explanation of the codes used is given below.

Table A A.1. Adjudication rules for school or principal data in TALIS 2018

School participation (returned principal questionnaires)		Risk of school non-response bias	Rating
Before replacement	After replacement		
≥75%	≥75%		Good
50% - 75%	≥75%		Fair (A)
	50% - 75%	Low	Fair (C)
		High	Poor (D)
<50%			Insufficient

Table A A.2. Adjudication rules for teacher data in TALIS 2018

School participation (minimum teacher participation)		Teacher participation after school replacement	Risk of teacher non-response bias	Rating
Before replacement	After replacement			
≥75%	≥75%	≥75%		Good
		50% - 75%		Fair (A)
50% - 75%	≥75%	≥75%		Fair (B)
		50% - 75%	Low	Fair (C)
			High	Poor (D)
50% - 75%	50% - 75%			Poor (E)
< 50%	≥75%			Poor (F)
< 50%	< 75%			Insufficient

The following bulleted list is a simple guide to help data users appreciate the limitations on use or quality:

- **Good:** The participating country's/territory's data can be used for all reporting and analytical purposes and can be included in international comparisons.
- **Fair (A):** National and sub-national estimates can be produced; some teacher characteristics may suffer from a larger standard error (S.E.), hence the warning "Fair", and no additional warnings to users appear necessary.

- **Fair (B, only for teacher data adjudication):** National and sub-national estimates can be produced; some sub-national estimates may be of lower precision (larger S.E.) if sample size is locally low, hence the warning "Fair", and no additional warnings to users appear necessary.
- **Fair (C):**
  - National and sub-national estimates can be produced.
  - Some sub-national estimates may be of lower precision (larger S.E.) if sample size is locally low, hence the warning "Fair", but a note on data quality could appear, pointing to the outcome of the non-response bias analysis (NRBA).
  - Since school participation is somewhat lower than under (B), comparing sub-national estimates should be done with care, as some of those results are based on few schools.
  - Comparing small sub-national estimates with similar groups from other countries/territories is likely to uncover any statistically meaningful differences, as the S.E. are likely too large.
- **Poor (D):**
  - In addition to the warnings issued for the previous category, a note should warn users of indications of non-response biases in some estimates.
  - Comparisons of sub-national estimates should be limited to the groups with the larger sample sizes.
  - At this point, the sample represents between 37% and 56% of the teaching workforce, from a rather small sample of schools.
  - Comparisons with similar groups in foreign countries would not be encouraged.
- **Poor (E, only for teacher data adjudication):** Sub-national estimates would not be recommended; there should be a note pointing out the difficulty of obtaining a representative sample of schools.
- **Poor (F, only for teacher data adjudication):** Limitations similar to those of line E, but there should be a note pointing out the difficulty of obtaining at least 50% participation of the selected sample of schools; risks of having a non-representative sample of schools.
- **Insufficient:** Weights should not be calculated for any official tabulations; hence, data should not be incorporated into international tables, models, averages, etc.

The participation rates and the adjudication rating per participating country/territory at ISCED level 2 are presented in Table A A.3 and Table A A.4.[1]

Notes regarding the use and interpretation of the data

This section lists issues to be noted regarding the sampling or field operations that should be considered when interpreting the ISCED level 2 data reported for these countries.

- **Alberta (Canada):**
  - TALIS data collection was conducted during a labour dispute.
  - Non-response bias analysis shows no evidence of high risk of school non-response bias on the investigated variables for teachers or principals and, as such, their rating was upgraded from "poor" to "fair".
- **Australia:**
  - The data collection window for both teachers and principals was extended from the end of the academic year in 2017 to the beginning of the following academic year in 2018.
  - For principals, data from Australia are located below the line in selected tables in this report and not included in the calculations for the international average. This is because Australia did

not meet the international standards for participation rates, as shown in Table A A.3 and Table A A.4.

- **Colombia:** Non-response bias analysis shows no evidence of high risk of school non-response bias on the investigated variables for teachers or principals and, as such, their rating was upgraded from "poor" to "fair".
- **Denmark:** Non-response bias analysis shows no evidence of high risk of school non-response bias on the investigated variables for teachers or principals and, as such, their rating was upgraded from "poor" to "fair".
- **Flemish Community of Belgium:** Entries on the sampling frame are administrative units and not "schools" as they are usually defined; a "school" may be comprised of one or several administrative units and the principal would be reporting for the school and not only the selected administrative unit. Therefore, users should exercise care when analysing and comparing school level statistics.
- **French Community of Belgium:** Items regarding the share of students with special needs should be interpreted carefully due to complications that could arise from the interpretation of the definition of special needs. Students studying for a differentiated first degree, which is organised for students who did not pass their primary certificate and who receive extra support and resources, are formally identified as having learning difficulties but most of them do not suffer from any kind of disability.
- **Georgia:** Some translation issues could still exist in the Georgian and Azerbaijani version of the questionnaires.
- **Israel:** Coverage falls below 95%, after *post facto* exclusion of ultraorthodox schools for low response rates, making coverage identical to that of TALIS 2013.
- **Latvia:** Some translation issues could still exist in the national instruments that could affect the data.
- **Korea:** In four schools, teacher listings were found to be incorrect; those schools were set to "non-participant".
- **Netherlands:**
    - The Netherlands had a six-week early start and extended collection window.
    - The Netherlands had an unapproved collection protocol that resulted in the inclusion of some 50 "national" schools that were not included in the international dataset but were left on the national dataset; participation rates were computed on the international dataset.
- **New Zealand:** Coverage was extended to small schools (four or fewer teachers). While the impact of this action on the target population of teachers was negligible, the impact on the target population of principals is important because, compared to TALIS 2013, the target population for principals nearly doubled in size.
- **Russian Federation:** Coverage falls below 95% after the exclusion of Moscow.
- **Saudi Arabia:** Coverage falls below 95% after the sampling excluded two provinces bordering Yemen.
- **Singapore:** Coverage included both privately and publicly managed schools. Nevertheless, private schools were excluded from the sample in TALIS 2013 due to confidentiality issues.
- **United Arab Emirates:** Because of the selection of multi-level schools, the principal data were copied from the original ISCED level 2 principal questionnaire to the corresponding ISCED level 1 and ISCED level 3 forms, except for Question 17 in the principal questionnaire.

Table A A.3. ISCED 2 principals' participation and recommended ratings

	Number of participating principals	Estimated size of principal population	Principals' participation before replacement (%)	Principals' participation after replacement (%)	Recommended rating
Alberta (Canada)	129	1 038	54.4	66.2	Fair
Australia	230	2 680	49.0	75.7	Insufficient
Austria	277	1 483	96.0	100.0	Good
Flemish Community (Belgium)	188	721	82.5	94.0	Good
French Community (Belgium)	119	448	93.3	99.2	Fair
Brazil	184	52 187	88.0	95.4	Good
Bulgaria	200	1 730	97.5	100.0	Good
Chile	169	5 214	78.9	87.6	Good
CABA (Argentina)[1]	121	488	77.5	82.6	Good
Colombia	141	10 392	68.8	70.9	Fair
Croatia	188	896	95.0	95.6	Good
Cyprus	88	99	88.9	88.9	Good
Czech Republic	218	2 606	99.5	99.5	Good
Denmark	140	1 457	51.5	71.4	Fair
England (UK)	157	3 990	71.9	81.8	Fair
Estonia	195	389	88.3	100.0	Good
Finland	148	706	100.0	100.0	Good
France	195	6 770	97.6	98.0	Good
Georgia	177	2 151	91.7	91.7	Good
Hungary	182	2 640	91.2	94.3	Good
Iceland	101	136	74.3	74.3	Fair
Israel	184	1 196	90.9	93.7	Good
Italy	190	5 622	92.4	98.6	Good
Japan	195	10 071	93.9	99.4	Good
Kazakhstan	331	6 302	100.0	100.0	Good
Korea	150	3 134	68.1	77.8	Fair
Latvia	136	653	80.4	91.9	Good
Lithuania	195	833	100.0	100.0	Good
Malta	54	58	93.1	93.1	Good
Mexico	193	16 327	90.6	97.0	Good
Netherlands	125	524	56.2	85.6	Fair
New Zealand	189	1 732	71.7	92.0	Fair
Norway	162	1 091	67.5	81.0	Fair
Portugal	200	1 255	97.7	100.0	Good
Romania	199	4 658	100.0	100.0	Good
Russian Federation	230	31 948	99.1	100.0	Good
Saudi Arabia	192	6 119	96.5	96.5	Good
Shanghai (China)	198	630	100.0	100.0	Good
Singapore	167	193	97.0	98.8	Good
Slovak Republic	180	1 593	84.4	90.5	Good
Slovenia	119	448	74.8	79.3	Good
South Africa	169	8 026	92.3	92.3	Good
Spain	396	6 861	98.7	99.2	Good
Sweden	171	1 739	85.9	89.1	Good
Chinese Taipei	202	935	100.0	100.0	Good
Turkey	196	16 100	99.0	99.0	Good
United Arab Emirates	476	521	91.4	91.4	Good
United States	164	65 095	63.1	77.6	Fair
Viet Nam	196	10 799	100.0	100.0	Good

1. CABA (Argentina): Ciudad Autónoma de Buenos Aires, Argentina.

Table A A.4. ISCED 2 teachers' participation and recommended ratings

	Number of participating schools	Number of participating teachers	Estimated size of teacher population	School participation before replacement (%)	School participation after replacement (%)	Teacher participation in participating schools (%)	Overall teacher participation (%)	Recommended rating
Alberta (Canada)	122	1 077	9 991	51.8	62.6	83.0	52.0	Fair
Australia	233	3 573	116 679	50.3	76.6	77.7	59.6	Fair
Austria	246	4 255	45 869	85.9	88.8	84.4	75.0	Good
Belgium	302	5 257	34 442	86.0	95.1	86.9	82.6	Good
Flemish Community (Belgium)	182	3 122	18 615	80.0	91.0	84.4	76.8	Good
French Community (Belgium)	120	2 135	15 827	93	100	89.7	89.7	Fair
Brazil	185	2 447	568 510	89.9	96.6	94.9	91.6	Good
Bulgaria	200	2 862	21 208	97.1	100.0	98.3	98.3	Good
Chile	179	1 963	55 969	82.6	91.5	94.3	86.2	Good
CABA (Argentina)1	130	2 099	10 218	81.3	86.7	88.6	76.8	Good
Colombia	154	2 398	164 225	73.9	77.4	93.4	72.3	Fair
Croatia	188	3 358	15 762	95.4	96.2	87.0	83.7	Good
Cyprus	88	1 611	3 860	89.8	89.8	90.3	81.0	Good
Czech Republic	219	3 447	42 348	100.0	100.0	93.8	93.8	Good
Denmark	141	2 001	22 475	51.1	72.0	86.8	62.5	Fair
England (UK)	149	2 376	193 134	72.7	81.5	83.6	68.1	Fair
Estonia	195	3 004	7 354	86.6	100.0	95.2	95.2	Good
Finland	148	2 851	18 938	100.0	100.0	96.2	96.2	Good
France	176	3 006	197 013	87.3	87.8	88.1	77.3	Good
Georgia	192	3 101	38 195	99.5	99.5	95.8	95.3	Good
Hungary	189	3 245	44 018	94.9	97.7	95.0	92.8	Good
Iceland	123	1 292	1 883	90.4	90.4	75.8	68.5	Good
Israel	172	2 627	32 603	85.3	87.3	84.9	84.9	Good
Italy	191	3 612	190 447	92.8	99.1	93.5	93.0	Good
Japan	196	3 555	230 558	92.4	99.5	99.0	98.5	Good
Kazakhstan	331	6 566	195 383	100.0	100.0	99.8	99.8	Good
Korea	163	2 931	75 654	70.5	81.5	92.2	75.1	Fair
Latvia	135	2 315	12 003	77.1	91.2	87.9	80.2	Good
Lithuania	195	3 759	19 848	100.0	100.0	97.4	97.4	Good
Malta	55	1 656	1 941	94.8	94.8	86.5	82.0	Good
Mexico	193	2 926	254 794	90.4	96.3	94.3	90.8	Good
Netherlands	116	1 884	66 672	56.7	79.5	80.9	64.3	Fair
New Zealand	185	2 257	23 227	62.8	79.5	79.6	63.3	Fair
Norway	185	4 154	21 828	77.4	92.6	83.2	77.0	Good
Portugal	200	3 676	39 703	97.9	100.0	92.7	92.7	Good
Romania	199	3 658	66 039	100.0	100.0	98.3	98.3	Good
Russian Federation	230	4 011	646 405	98.7	100.0	99.9	99.9	Good
Saudi Arabia	179	2 744	99 661	89.7	89.7	86.0	77.1	Good
Shanghai (China)	198	3 976	38 902	100.0	100.0	99.5	99.5	Good
Singapore	169	3 280	11 544	98.2	100.0	99.2	99.2	Good
Slovak Republic	176	3 015	24 746	82.4	88.9	95.4	84.7	Good
Slovenia	132	2 094	7 422	82.2	88.0	91.5	80.5	Good
South Africa	170	2 046	92 127	92.3	92.9	89.7	83.3	Good

	Number of participating schools	Number of participating teachers	Estimated size of teacher population	School participation before replacement (%)	School participation after replacement (%)	Teacher participation in participating schools (%)	Overall teacher participation (%)	Recommended rating
Spain	399	7 407	186 171	99.5	100.0	94.6	94.6	Good
Sweden	180	2 782	31 421	89.1	93.9	81.3	76.3	Good
Chinese Taipei	200	3 835	53 208	99.0	99.0	97.2	96.2	Good
Turkey	196	3 952	277 187	99.0	99.0	98.5	97.5	Good
United Arab Emirates	521	8 648	14 489	100.0	100.0	96.0	96.0	Good
United States	165	2 560	1 144 751	60.1	76.8	89.6	68.8	Fair
Viet Nam	196	3 825	295 033	100.0	100.0	96.3	96.3	Good

1. CABA (Argentina): Ciudad Autónoma de Buenos Aires, Argentina.

References

OECD (2019), *TALIS 2018 Technical Report*, OECD, Paris, http://www.oecd.org/education/talis/TALIS_2018_Technical_Report.pdf. [1]

OECD (2018), *OECD Handbook for Internationally Comparative Education Statistics 2018: Concepts, Standards, Definitions and Classifications*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264304444-en. [2]

Note

[1] Table A A.3 and Table A A.4 display the participation rate estimates that were the most favourable for the adjudication rating. The most favourable estimates could have been weighted or unweighted depending on the characteristics of the country/territory, the teacher and principal populations and the educational level.

Annex B. Technical notes on analyses in this report

Use of teacher and school weights

The statistics presented in this report were derived from data obtained through samples of schools, school principals and teachers. The sample was collected following a stratified two-stage probability sampling design. This means that teachers (second-stage units or secondary sampling units) were randomly selected from the list of in-scope teachers for each of the randomly selected schools (first-stage or primary sampling units). For these statistics to be meaningful for a country, they needed to reflect the whole population from which they were drawn and not merely the sample used to collect them. Thus, survey weights must be used in order to obtain design-unbiased estimates of population or model parameters.

Final weights allow the production of country-level estimates from the observed sample data. The estimation weight indicates how many population units are represented by a sampled unit. The final weight is the combination of many factors reflecting the probabilities of selection at the various stages of sampling and the response obtained at each stage. Other factors may also come into play as dictated by special conditions to maintain the unbiasedness of the estimates (e.g. adjustment for teachers working in more than one school).

Statistics presented in this report that are based on the responses of school principals and that contribute to estimates related to school principals were estimated using school weights (SCHWGT). Results based only on responses of teachers or on responses of teachers and principals (i.e. responses from school principals were merged with teachers' responses) were weighted by teacher weights (TCHWGT).

Use of complex variables and scales

In this report, several scale indices are used in regression analyses. Descriptions of the construction and validation of these scales can be found in Chapter 11 of the *TALIS 2018 Technical Report* (OECD, 2019[1]).

International averages

The OECD and TALIS averages, which were calculated for most indicators presented in this report, correspond to the arithmetic mean of the respective country estimates. When the statistics are based on responses of teachers, the OECD and TALIS averages cover 31 and 48 countries and territories, respectively (Table A B.1). In those cases where the analysis is based on principals' responses, the OECD and TALIS averages cover 30 and 47 countries and territories, respectively.

The EU total represents the 23 European Union member states that also participated in TALIS 2018 as a single entity and to which each of the 23 EU member states contribute in proportion to the number of teachers or principals, depending on the basis of the analysis. Therefore, the EU total is calculated as a weighted arithmetic mean based on the sum of final teacher (TCHWGT) or principal (SCHWGT) weights by country, depending on the target population.

Table A B.1. Country coverage of international averages in TALIS 2018

	TALIS average-48 (teachers)	TALIS average-47 (principals)	OECD average-31 (teachers)	OECD average-30 (principals)	EU total-23
Alberta (Canada)	x	x	x	x	–
Australia	x	–	x	–	–
Austria	x	x	x	x	x
Belgium	x	x	x	x	x
Flemish Comm. (Belgium)	–	–	–	–	–
French Comm. (Belgium)	–	–	–	–	–
Brazil	x	x	–	–	–
Bulgaria	x	x	–	–	x
CABA (Argentina)	x	x	–	–	–
Chile	x	x	x	x	–
Colombia[1]	x	x	x	x	–
Croatia	x	x	–	–	x
Cyprus	x	x	–	–	x
Czech Republic	x	x	x	x	x
Denmark	x	x	x	x	x
England (UK)	x	x	x	x	x
Estonia	x	x	x	x	x
Finland	x	x	x	x	x
France	x	x	x	x	x
Georgia	x	x	–	–	–
Hungary	x	x	x	x	x
Iceland	x	x	x	x	–
Israel	x	x	x	x	–
Italy	x	x	x	x	x
Japan	x	x	x	x	–
Kazakhstan	x	x	–	–	–
Korea	x	x	x	x	–
Latvia	x	x	x	x	x
Lithuania	x	x	x	x	x
Malta	x	x	–	–	x
Mexico	x	x	x	x	–
Netherlands	x	x	x	x	x
New Zealand	x	x	x	x	–
Norway	x	x	x	x	–
Portugal	x	x	x	x	x
Romania	x	x	–	–	x
Russian Federation	x	x	–	–	–
Saudi Arabia	x	x	–	–	–
Shanghai (China)	x	x	–	–	–
Singapore	x	x	–	–	–
Slovak Republic	x	x	x	x	x
Slovenia	x	x	x	x	x
South Africa	x	x	–	–	–
Spain	x	x	x	x	x
Sweden	x	x	x	x	x
Chinese Taipei	x	x	–	–	–
Turkey	x	x	x	x	–
United Arab Emirates	x	x	–	–	–
United States	x	x	x	x	–
Viet Nam	x	x	–	–	–

1. CABA (Argentina): Ciudad Autónoma de Buenos Aires, Argentina.

In this publication, the OECD average is generally used when the focus is on providing a global tendency for an indicator and comparing its values across education systems. In the case of some countries and territories, data may not be available for specific indicators, or specific categories may not apply. Therefore, readers should keep in mind that the term "OECD average" refers to the OECD countries and territories included in the respective comparisons. In cases where data are not available or do not apply to all sub-categories of a given population or indicator, the "OECD average" may be consistent within each column of a table but not necessarily across all columns of a table.

Differences between sub-groups

Differences between sub-groups among school characteristics (e.g. between schools with a high concentration of students from socio-economically disadvantaged homes and schools with a low concentration of students from socio-economically disadvantaged homes) were tested for statistical significance. All differences marked in bold in the data tables of this report are statistically significantly different from 0 at the 95% level.

In the case of differences between sub-groups, the standard error is calculated by taking into account that the two sub-samples are not independent. As a result, the expected value of the covariance might differ from 0, leading to smaller estimates of standard error as compared to estimates of standard error calculated for the difference between independent sub-samples.

Tables presenting the proportion of teachers and principals, by the school breakdown variables (Tables A B.2 and A B.3) can be found in Annex C.

Dissimilarity index

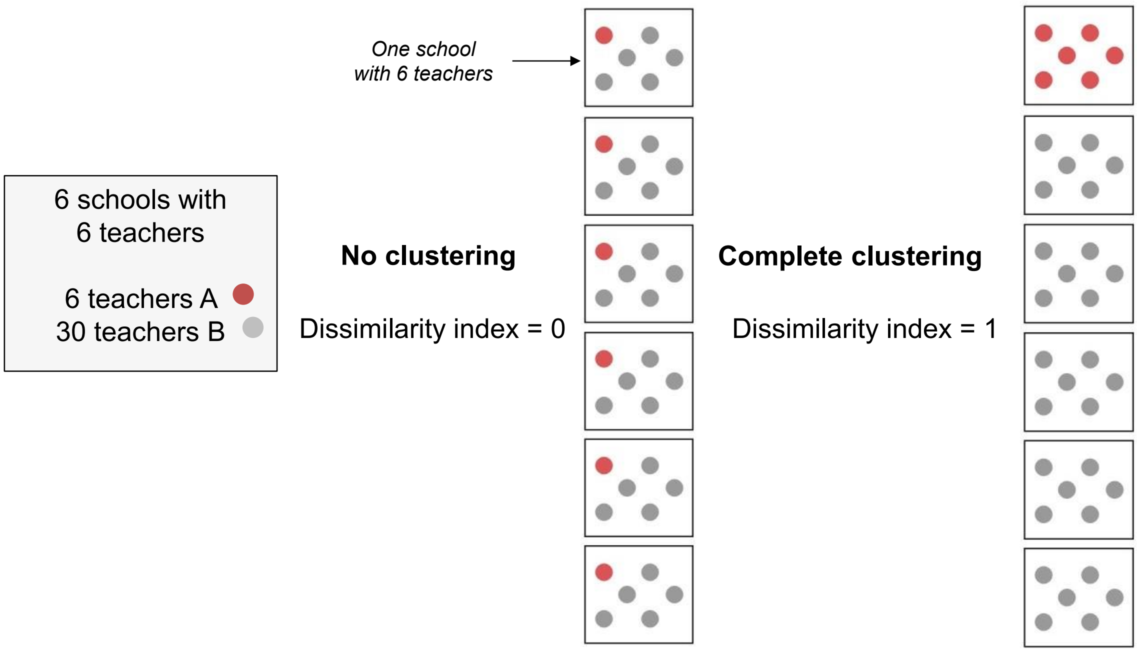
The dissimilarity index, which is commonly used as a measure of segregation, captures to what extent the distribution of teachers in schools deviates from what would have been observed if they were distributed randomly across schools. It is related to the proportions of teachers of two mutually exclusive groups (e.g. teachers with a master's degree and teachers without a master's degree) who have to be reallocated in order to obtain an identical distribution across all schools. Thus, in the context of this report, the dissimilarity index measures whether teachers with certain traits are clustered in a limited number of schools. Clustering arises whenever similar individuals (in this case, teachers with similar characteristics) end up together (in this case, working in the same school). Formally, the dissimilarity index may be written as:

$D = \frac{1}{2}\sum_{j=1}^{J}\left|\frac{n_j^a}{N^a} - \frac{n_j^b}{N^b}\right|$, where n_j^b (respectively N^b) stands for the number of teachers in school j with Type b (respectively, in the country).

Thus, this index measures the dissimilarity between the distribution of type a teachers across schools and the distribution of Type b teachers across schools (OECD, 2019[2]). It may be interpreted as the proportion of one or the other group that has to be displaced in order to achieve evenness (assuming that school size may be adjusted), or as the average proportions of teachers of both group a and group b that have to be reallocated in order to achieve evenness, maintaining equal school size.

The dissimilarity index ranges from 0 (i.e. the allocation of teachers in schools perfectly resembles the teacher population of the country) to 1 (i.e. teachers with a certain characteristic are concentrated in a single school). A high dissimilarity index means that the distribution of teachers with a certain characteristic is very different from what would be observed if they were distributed randomly across schools. Hence, it is an indication of teachers with a certain characteristic being highly concentrated in certain schools. Figure A B.1 shows an example in which teachers may be Type A or Type B. They are distributed across six schools, each with a capacity of six teachers. Complete clustering is observed when all the Type A teachers are in one and only one school. No clustering corresponds to a situation where all schools are equally composed of one Type A teacher and five Type B teachers.

Figure A B.1. Complete vs no clustering case (illustrative example)



By design, the value of the dissimilarity index increases as the overall shares of both groups in the teacher population becomes more unbalanced, based on the specific teacher characteristic being analysed. In those cases, where the share of teachers with a certain characteristic in the overall teacher population is either very small or large, the value of the dissimilarity index tends to be high. In the extreme case, when there are more schools than actual teachers with a certain characteristic in a country, the value of the dissimilarity index is larger than zero, even if these teachers are randomly allocated across schools (OECD, 2019[2]). Thus, the comparability of the dissimilarity index across countries warrants caution, especially when the group of teachers with certain characteristic that is analysed varies considerably across countries.

In addition, the value of the dissimilarity index is also affected by the size of the units (i.e. schools) across which the distribution of individuals are analysed. Notably, if the units' sizes are small, then the dissimilarity index tends to overestimate the level of deviations from randomness (also known as small-unit bias) (Carrington and Troske, 1997[3]; D'Haultfœuille, Girard and Rathelot, 2021[4]; D'Haultfœuille and Rathelot, 2017[5]). For example, the smaller the schools in terms of the number of teachers teaching in the school, the more likely it is to observe a deviation from the random allocation of teachers with certain characteristics.

Statistics based on regressions

Regression analyses were carried out for each country separately. Similarly to other statistics presented in this report, the OECD and TALIS averages refer to the arithmetic mean of country-level estimates, while the EU total is calculated as a weighted arithmetic mean based on the sum of final teacher (TCHWGT) or principal (SCHWGT) weights by country, depending on the target population.

In order to ensure the robustness of the regression models, independent variables were introduced into the models in steps. This approach also required that the models at each step be based on the same sample. The restricted sample used for the different versions of the same model corresponded to the sample of the most extended (i.e. with the maximum number of independent variables) version of the model. Thus, the restricted sample of each regression model excluded those observations where all independent variables had missing values.

Statistics based on multilevel models

Statistics based on multilevel models include variance components (between- and within-school variance), the intra-class correlation derived from these components, and regression coefficients (where this has been indicated). Multilevel models in this report are specified as two-level regression models (the teacher and school levels) and estimated with maximum likelihood estimation.

Weights are used at both the teacher and school levels. The purpose of these weights is to account for differences in the probabilities of teachers being selected in the sample. Final teacher weights (TCHWGT) were used as teacher-level sampling weights. Teachers' within-school weights correspond to final teacher weights, rescaled to amount to the sample size within each school. Final school weights (SCHWGT) were used as school-level sampling weights.

Estimates based on multilevel models depend on how schools are defined and organised within countries and territories and how they are chosen for sampling purposes. Schools may have been defined differently in the TALIS sample, depending on the country/territory. Namely, they can be defined as: administrative units (even if they spanned several geographically separate institutions); as those parts of larger educational institutions that serve students at the ISCED level concerned; as physical school buildings; or, rather, from a management perspective (e.g. establishments having a principal). Annex E of the *TALIS 2018 Technical Report* includes information on how countries and territories defined schools in their respective systems (OECD, 2019[1]). In particular, the between-school variance estimates can be affected if the variables used for stratification, a process aimed at reducing variation within strata, are associated with between-school differences.

Multilevel logistic models can be viewed as latent-response models (Gelman and Hill, 2007[6]; Goldstein, Browne and Rasbash, 2002[7]; Rabe-Hesketh and Skrondal, 2012[8]). In this report, the observed dichotomous response y_i (i.e. whether teachers use information and communication technology [ICT] for instruction on a regular basis or not) is assumed to arise from an unobserved or latent continuous response y_i^* that represents the propensity to use ICT for instruction. If this latent response is greater than 0, then the observed response is 1; otherwise, the observed response is 0:

$$y_i = \begin{cases} 1 \; if \; y_i^* > 0 \\ 0 \; otherwise \end{cases}$$

Multilevel linear models were estimated using the Stata (version 17.0) "mixed" module, while the multilevel logistic models were estimated with the "melogit" module.

Intra-class correlation

The index of intra-class correlation represents the share of the variance that lies between the cluster variable – in this case, schools – and it is defined and estimated as:

$$100 \times \frac{\sigma_B^2}{\sigma_W^2 + \sigma_B^2}$$

where σ_B^2 and σ_W^2, respectively, represent the between- and within-variance estimates. In the case of multilevel logistic models, the assumed within-school variance component (σ_W^2) is the standard logistic distribution, that is $(\pi^2/3) \approx 3.29$. Therefore, the index of intra-class correlation is estimated as:

$$100 \times \frac{\sigma_B^2}{\pi^2/3 + \sigma_B^2}$$

Standard errors in statistics estimated from multilevel models

For statistics based on multilevel models, such as the estimates of variance components and regression coefficients from two-level regression models, the standard errors are not estimated with the usual replication method, which accounts for stratification and sampling rates from finite populations. Instead, standard errors are "model-based": their computation assumes that schools, and teachers within schools, are sampled at random (with sampling probabilities reflected in school and teacher weights) from a theoretical, infinite population of schools and teachers, which complies with the model's parametric assumptions. The standard error for the estimated intra-class correlation is calculated by deriving an approximate distribution for it from the (model-based) standard errors for the variance components, using the delta method.

Statistics based on binary logistic regressions

Binary logistic regression analysis enables the estimation of the relationship between one or more independent (or explanatory) variables and the dependent (or outcome) variable with two categories. The regression coefficient (β) of a logistic regression is the estimated increase in the log odds of the outcome per unit increase in the value of the predictor variable.

More formally, let Y be the binary outcome variable indicating no/yes with 0/1, and p be the probability of Y to be 1, so that $p = prob(Y = 1)$. Let $x_1, \ldots x_k$ be a set of explanatory variables. Then, the logistic regression of Y on $x_1, \ldots x_k$ estimates parameter values for $\beta_0, \beta_1, \ldots, \beta_k$ via the maximum likelihood method of the following equation:

$$Logit(p) = \log(p/(1-p)) = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k$$

Additionally, the exponential function of the regression coefficient (e^{β}) is obtained, which is the odds ratio (OR) associated with a one-unit increase in the explanatory variable. Then, in terms of probabilities, the equation above is translated into the following:

$$p = \frac{e^{(\beta_0 + \beta_1 X_1 + \cdots + \beta_k X_k)}}{(1 + e^{(\beta_0 + \beta_1 X_1 + \cdots + \beta_k X_k)})}$$

The transformation of log odds (β) into odds ratios (e^{β}; OR) makes the data more interpretable in terms of probability. The odds ratio (OR) is a measure of the relative likelihood of a particular outcome across two groups. The odds ratio for observing the outcome when an antecedent is present is:

$$OR = \frac{p_{11}/p_{12}}{p_{21}/p_{22}}$$

where p_{11}/p_{12}represents the "odds" of observing the outcome when the antecedent is present, and p_{21}/p_{22} represents the "odds" of observing the outcome when the antecedent is not present. Thus, an odds ratio indicates the degree to which an explanatory variable is associated with a categorical outcome variable with two categories (e.g. yes/no) or more than two categories. An odds ratio below one denotes a negative association; an odds ratio above one indicates a positive association; and an odds ratio of one means that there is no association. For instance, if the association between being a female teacher and having chosen teaching as first choice as a career is being analysed, the following odds ratios would be interpreted as:

- **0.2:** Female teachers are five times less likely to have chosen teaching as a first choice as a career than male teachers.
- **0.5:** Female teachers are half as likely to have chosen teaching as a first choice as a career than male teachers.
- **0.9:** Female teachers are 10% less likely to have chosen teaching as a first choice as a career than male teachers.

- **1**: Female and male teachers are equally likely to have chosen teaching as a first choice as a career.
- **1.1:** Female teachers are 10% more likely to have chosen teaching as a first choice as a career than male teachers.
- **2:** Female teachers are twice as likely to have chosen teaching as a first choice as a career than male teachers.
- **5:** Female teachers are five times more likely to have chosen teaching as a first choice as a career than male teachers.

The odds ratios in bold indicate that the relative risk/odds ratio is statistically significantly different from 1 at the 95% confidence level. To compute statistical significance around the value of 1 (the null hypothesis), the relative-risk/odds-ratio statistic is assumed to follow a log-normal distribution, rather than a normal distribution, under the null hypothesis.

Binary logistic regressions cannot provide a goodness-of-fit measure that would be equivalent to the R-squared (R^2), which represents the proportion of the observed variation in the dependent (or outcome) variable that can be explained by the independent (or explanatory) variables. Unlike linear regressions with normally distributed residuals, it is not possible to find a closed-form expression for the coefficient values that maximise the likelihood function of logistic regressions; thus, an iterative process must be used instead. Yet, the goodness-of-fit of binary logistic models can be evaluated by the pseudo-R^2.[1] Similarly to the R^2, the pseudo-R^2 also ranges from 0 to 1, with higher values indicating better model fit. Nevertheless, pseudo-R^2 cannot be interpreted as one would interpret the R^2.

Pearson correlation coefficient

Correlation coefficient measures the strength and direction of the statistical association between two variables. Correlation coefficients vary between -1 and 1; values around 0 indicate a weak association, while the extreme values indicate the strongest possible negative or positive association. The Pearson correlation coefficient (indicated by the letter r) measures the strength and direction of the linear relationship between two variables.

In this report, Pearson correlation coefficients are used to quantify relationships between country/territory-level statistics. With only two variables (x and y), the R-squared measure (indicated by R^2) of the linear regression of y on x (or, equivalently, of x on y) is the square of the Pearson correlation coefficient between the two variables.

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Note

[1] Among the various different types of pseudo-R^2, this report applies McFadden's pseudo-R^2.

Annex C. List of tables available on line

The following tables are available in electronic form only – please follow the StatLink after each table below to access them.

Table A C.1. Online tables for Chapter 2 – Do students have equitable access to effective teachers and learning environments?

Table 2.3	Allocation of experienced teachers
Table 2.4	Total variation in teachers' work experience as a teacher, and variation between and within schools
Table 2.5	Allocation of teachers with comprehensive formal education or training
Table 2.6	Allocation of teachers with high self-efficacy
Table 2.7	Total variation in teachers' self-efficacy, and variation between and within schools
Table 2.8	Allocation of teachers who use cognitive activation practices on a regular basis
Table 2.9	Total variation in teachers' use of cognitive activation practices, and variation between and within schools
Table 2.10	Allocation of teachers who use clarity of instruction practices on a regular basis
Table 2.11	Total variation in teachers' use of clarity of instruction practices, and variation between and within schools
Table 2.12	Allocation of teachers who spend a large share of class time on actual teaching
Table 2.13	Total variation in time spent on actual teaching and learning, and variation between and within schools
Table 2.14	Principals' engagement in instructional leadership activities, by school characteristics
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Table 2.21	Relationship between the use of clarity of instruction practices and teacher characteristics by school location
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Table 2.23	Residual variability in teachers' use of clarity of instruction practices after accounting for teacher characteristics
Table 2.24	Relationship between time spent on actual teaching and learning and teacher characteristics by concentration of students from socio-economically disadvantaged homes
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Table 2.26	Relationship between time spent on actual teaching and learning and teacher characteristics by school type
Table 2.27	Residual variability in time spent on actual teaching and learning after accounting for teacher characteristics

StatLink https://stat.link/r2xn59

Table A C.2. Online tables for Chapter 3 – Do students have equitable access to digital learning in school?

Table 3.1	Teachers with high self-efficacy in the use of ICT for teaching, by schools' digital infrastructure
Table 3.2	Teachers who use ICT for teaching on a regular basis, by schools' digital infrastructure
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Table 3.4	Insufficient Internet access, by school characteristics
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Table 3.6	Allocation of teachers who felt prepared for the use of ICT for teaching
Table 3.7	Allocation of teachers who participated in professional development in ICT skills
Table 3.8	Allocation of teachers with high level of need for professional development in ICT skills
Table 3.9	Relationship between the extent to which teachers use ICT and teachers' self-efficacy in the use of ICT, controlling for teacher characteristics, training in the use of ICT and classroom composition
Table 3.10	Relationship between teachers' self-efficacy in the use of ICT and teachers' age
Table 3.11	Relationship between teachers' self-efficacy in the use of ICT and teachers' age, controlling for teacher characteristics, training in the use of ICT and classroom composition
Table 3.12	Allocation of teachers with high self-efficacy in the use of ICT for teaching
Table 3.13	Relationship between the extent to which teachers use ICT and teachers' age
Table 3.14	Relationship between the extent to which teachers use ICT and teachers' age, controlling for teacher characteristics, training in the use of ICT and classroom composition
Table 3.15	Allocation of teachers who use ICT for teaching on a regular basis
Table 3.16	Variation in teachers' regular use of ICT for teaching, after controlling for teacher and school characteristics and schools' digital infrastructure
Table 3.17	Relationship between the extent to which teachers use ICT and teachers' engagement in professional collaboration, controlling for teacher characteristics, training in the use of ICT and classroom composition

StatLink https://stat.link/syfrol

Table A C.3. Online tables for Annex B – Technical notes on analyses in this report

Table A B.2	Teachers, by school characteristics
Table A B.3	Principals, by school characteristics

StatLink https://stat.link/5h9mei

TALIS

Mending the Education Divide

GETTING STRONG TEACHERS TO THE SCHOOLS THAT NEED THEM MOST

Teachers can shape their students' educational careers. Research shows that children taught by different teachers often experience very different educational outcomes. This begs the questions: how are teachers assigned to schools in different countries? And to what extent do students from different backgrounds have access to good teachers? Building on literature identifying the characteristics and practices of teaching that boost student achievement, this report shows how teachers with different characteristics and practices tend to concentrate in different schools, and how much access students with different socio-economic backgrounds have to good teachers. It points out the aspects of different educational systems that influence how teachers are allocated to schools. The report also discusses the consequences that inequitable teacher allocation systems have on students' educational outcomes.

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