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## **Overview: What the TALIS-PISA link insights imply for policy and future research**

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This OECD report on the results of the TALIS-PISA link 2018 focuses on the many ways teachers and schools matter for student achievement and social-emotional development. This chapter provides an overview of the datasets upon which this report is based, as well as the statistical methods – including a machine learning technique – used to analyse them. It also provides an overview of the report’s main findings, followed by several directions for education policy. Finally, it offers recommendations for improving the current survey design in order to better examine and understand the connection between teaching and learning in the future.

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## Introduction

*Positive, High-achieving Students? What Schools and Teachers Can Do* acknowledges the multiplicity of teaching and schooling goals. Not only do teachers need to provide students with cognitive skills so they can find employment and thrive in life but they are also expected to efficiently select and sort students based on their abilities and interest, promote equality of opportunity, and provide students with the skills to become active citizens (Van De Werfhorst and Mijs, 2010<sup>[1]</sup>). This reports sheds light on the many ways teachers contribute to these goals and, ultimately, the development of children and young people.

The pressure put on teachers has only become greater since the outbreak of the COVID-19 pandemic. With school closures, the rapid expansion of distant and blended learning, and physical distancing needs at school, teachers have had to rethink the way they teach, organise their time, and interact with students, parents and colleagues. More than ever, education systems are revisiting the way they train their teachers and support them in changing learning conditions. The findings of this report can help educational stakeholders review their practices as it provides ample illustration of the many ways in which teachers are effective for student achievement and socio-emotional development and for ensuring that all students thrive, no matter what their personal characteristics and circumstances.

Identifying the teacher and school factors that help younger generations to succeed and thrive later in life has long been a main interest for education policy. Past education research has shown that how teachers, school leaders and schools shape the quality of instruction and students' environment impacts strongly on student academic and social-emotional development (Barber and Mourshed, 2009<sup>[2]</sup>; Darling-Hammond, 2017<sup>[3]</sup>; OECD, 2018<sup>[4]</sup>).

Past studies have found that teacher quality is the most important school-related predictor of student achievement (Hattie, 2009<sup>[5]</sup>; Rice, 2003<sup>[6]</sup>; Seidel and Shavelson, 2007<sup>[7]</sup>; Wayne and Youngs, 2003<sup>[8]</sup>). "Teacher effect"<sup>1</sup> (or a teacher's value-added) accounts for significant variation in student achievement (Chetty, Friedman and Rockoff, 2014<sup>[9]</sup>; Chetty, Friedman and Rockoff, 2014<sup>[10]</sup>; Hanushek and Rivkin, 2010<sup>[11]</sup>; Jackson, Rockoff and Staiger, 2014<sup>[12]</sup>; Kane and Staiger, 2008<sup>[13]</sup>; Rivkin, Hanushek and Kain, 2005<sup>[14]</sup>; Rockoff, 2004<sup>[15]</sup>). The estimated magnitude of teacher effect is relatively large compared to the effects of other school factors (Jackson, Rockoff and Staiger, 2014<sup>[12]</sup>).

There is also evidence that teachers matter for student social-emotional skills. Studies on teacher value-added have found that, as with test scores, teachers vary considerably in their ability to impact students' social and emotional development, including a variety of observed school behaviours (Gershenson, 2016<sup>[16]</sup>; Jackson, 2018<sup>[17]</sup>; Jennings and DiPrete, 2010<sup>[18]</sup>; Koedel, 2008<sup>[19]</sup>; Kraft, 2019<sup>[20]</sup>; Ladd and Sorensen, 2017<sup>[21]</sup>; Ruzek et al., 2015<sup>[22]</sup>).

Building on this evidence, this report aims to identify the specific characteristics and actions of teachers and schools that matter for student achievement and social-emotional development. While doing so, it acknowledges the growing body of research literature suggesting that teacher effects are multidimensional. First, teacher effects can differ depending on the student outcome of interest. Several studies found that teachers who make a difference for students' academic performances are not necessarily equally good at contributing to students' social and emotional development (Gershenson, 2016<sup>[16]</sup>; Jackson, 2018<sup>[17]</sup>; Jennings and DiPrete, 2010<sup>[18]</sup>; Kraft, 2019<sup>[20]</sup>; Ruzek et al., 2015<sup>[22]</sup>). Second, teacher effects are susceptible to variation, depending on student background. For instance, teachers may interact differently with boys and girls, or with socially disadvantaged and socially advantaged students, depending on their beliefs about their interests and abilities (Hadjar et al., 2014<sup>[23]</sup>). In addition, certain teaching strategies may be more effective among certain groups of students than among others (Le Donné, Fraser and Bousquet, 2016<sup>[24]</sup>; OECD, 2015<sup>[25]</sup>). Consequently, this report aims to address the following questions:

- Chapter 2: What do schools and teachers do that matters most for student achievement?

- Chapter 3: What do schools and teachers do that matters most for student social and emotional development?
- Chapter 4: Does what teachers and schools do matter differently depending on student achievement and gender?

Chapter 1 summarises the results highlighted across the report and tackles the cross-cutting question of the multidimensional nature of teacher and school practices and policies – do teacher and school factors matter equally for all student outcomes and for all students? Or, do some factors matter more (or differently) for certain student outcomes and groups of students? Chapter 1 presents policy implications based on the main findings of the report. It also highlights a number of unresolved questions and offers recommendations for future data collection and avenues for further research.

### ***The TALIS-PISA link data***

To address these important research and policy questions, this report draws entirely upon combined TALIS 2018 and PISA 2018 data.<sup>2</sup> Since the first cycle of TALIS in 2008, the OECD has striven to describe teaching and learning environments from the point of view of teachers and school leaders. Likewise, since the first cycle of PISA in 2000, the OECD has endeavoured to measure student achievement and social-emotional skills, and identify school practices and policies that are associated with the performance and equity of education systems. With the TALIS-PISA link option, the OECD and the participating countries and economies have put together these two parts of the puzzle – TALIS and PISA – to obtain as complete a view as possible of what happens in today's schools.

TALIS 2018 provides substantial data from nationally representative samples of teachers on the background, beliefs and practices of lower secondary teachers and the principals of their schools (OECD, 2019<sub>[26]</sub>). It is the largest international survey that focuses on the working conditions of teachers and school leaders, and the learning environment in their schools. TALIS aims to provide valid, timely and comparable information to help countries review and define policies for a high quality teaching profession (Ainley and Carstens, 2018<sub>[27]</sub>; OECD, 2019<sub>[26]</sub>). It is an opportunity for teachers and school leaders to provide input into educational policy analysis and development in key areas of their work (OECD, 2020<sub>[28]</sub>; OECD, 2019<sub>[29]</sub>).

PISA 2018 delivers insights into the family and school background, and cognitive and social-emotional skills of 15-year-old students. It assesses to what extent children near the end of compulsory education have acquired the knowledge and skills needed in modern societies (OECD, 2019<sub>[30]</sub>; OECD, 2019<sub>[31]</sub>; OECD, 2019<sub>[32]</sub>). With regard to student achievement, this report uses student performances in all three subject domains traditionally assessed by PISA (reading, mathematics and science) with more weight given to reading since it was the focus domain of PISA 2018<sup>3</sup> (Chapters 2 and 4). In addition, the report analyses a broad range of social-emotional development indicators (Chapter 3) and examines four that vary more across schools in greater depth. These are: students' perceptions of their classroom climate, their teacher's enthusiasm for teaching, the difficulty of the PISA test, and students' expectations of completing at least a tertiary degree. Student background information – particularly gender, socio-economic and cultural status, and migration background – is used in the analysis to neutralise potential mediating effects of student characteristics (in all chapters) so as not to skew relations of interest. In Chapter 4, student background information is used to break down the student population into sub-groups – notably girls and boys – and estimate gender gaps in student achievement within schools.

TALIS offers data on several dimensions of teachers' and principals' work, as well as school characteristics and practices, which contextualise and frame students' cognitive performance and social-emotional skills as measured in PISA. Linking PISA with TALIS creates a rich dataset enabling student, teacher, principal and school data across countries to be connected.

A great advantage of this dataset is its international component. Most of the studies surrounding teacher and school effects are conducted in one specific country with little possibility of exploring whether the findings also hold for other national contexts. In TALIS 2018, participating countries and economies had the option of administering TALIS questionnaires to a PISA 2018 sub-sample of schools with the purpose of linking schools', principals', teachers' and students' data. Nine diverse countries and economies from four continents took part: Australia, Ciudad Autónoma de Buenos Aires (hereafter CABA [Argentina]), Colombia, the Czech Republic, Denmark, Georgia, Malta,<sup>4</sup> Turkey and Viet Nam<sup>5</sup> (Box 1.1).

### Box 1.1. The TALIS-PISA link 2018

The main features of the TALIS-PISA link 2018 are as follows:

- Participating countries/economies: Australia, CABA (Argentina), Colombia, the Czech Republic, Denmark, Georgia, Malta, Turkey and Viet Nam.
- Representative samples of schools and 15-year-old students within schools with a target nominal sample size of 150 schools per country and 35 students in each school. In each PISA-participating school, the school principal and a random sample of 20 teachers teaching 15 year-old students were selected.
- TALIS technical standards on response rates: the minimum response rate is 75% of sampled eligible and non-excluded schools and 75% of all sampled teachers across all participating schools.
- PISA technical standards on response rates: the minimum school response rate is 85% of sampled eligible and non-excluded schools and the minimum student response rate is 80% of all sampled students across all participating schools.
- TALIS teacher and school principal questionnaires were administered online and on paper. Some TALIS questions were adapted to refer to 15-year-old students.
- PISA questionnaires, including, in particular, the student questionnaire, as well as student assessments in reading (the main domain in 2018), mathematics and science were administered in computer- and paper-based mode.
- Data collection window: the TALIS questionnaires were administered in parallel with or shortly after the administration of the PISA instruments during the same school year.

Sources: OECD (2020<sub>[33]</sub>), *PISA 2018 Technical Report*, <https://www.oecd.org/pisa/data/pisa2018technicalreport>; OECD (2019<sub>[26]</sub>), *TALIS 2018 Technical Report*, [http://www.oecd.org/education/talis/TALIS\\_2018\\_Technical\\_Report.pdf](http://www.oecd.org/education/talis/TALIS_2018_Technical_Report.pdf).

The specific survey design of the TALIS-PISA link data has important implications for the interpretation of the results presented in this report. First, the link between the TALIS and PISA surveys operates at the school level and not at the class level. In other words, the data do not allow matching between a teacher and her or his students; rather, the data only permit matching between a sample of teachers teaching 15-year-old students in a school and a sample of 15-year-old students of that same school. While analysing the data, three types of links can be established between the TALIS and PISA data:

1. Individual student data can be merged with TALIS data from teachers and school principals aggregated at the school level.
2. Individual teacher and principal data can be merged with PISA data from students aggregated at the school level.
3. TALIS data aggregated at the school level can be merged with PISA data aggregated at the school level.

In this report, most of the analyses are conducted by connecting individual student data with data from teachers averaged at the school level and with school principal data. What is measured by TALIS data at the school level relates to a school's overall context and needs to be interpreted accordingly. The analyses presented in this report generally link the characteristics and practices of the average teacher in the school with the cognitive or social-emotional skills of individual students in the school. Therefore, the reported analyses are likely to be conservative to the extent that an association between an average teacher and individual student outcomes might not be significant due to the aggregation of different teachers' data at the school level even though, in reality, an individual teacher might contribute to an individual student's outcomes.

Another limitation of the study design is that both the TALIS and the PISA studies are cross-sectional, i.e. they measure student, teacher, principal and school characteristics in many countries, but at a single date. This survey design prevents causal interpretation of the reported analyses. The associations between student outcomes, and teacher and school factors highlighted in this report need to be cautiously interpreted and do not allow drawing any conclusions about teacher or school effectiveness.

Finally, it must be noted that this report draws on data collected in 2018, i.e. before the outbreak of the COVID-19 pandemic. Therefore this report cannot be informative about the teacher and school factors that have become more relevant for student cognitive and social-emotional development following crisis-induced changes, such as school closures, the rapid expansion of distant learning and teaching, or the imposition of physical distancing in the schools. Nevertheless, this should not unduly lessen the report's reach as the analyses aspire to some form of generality. They aim to identify teacher and school factors that generally contribute to student fulfilment. This quest goes beyond the contingencies of the current context. Some kind of generality can be claimed, for example, whenever a teacher factor is found to be consistently associated with a student outcome across several countries and/or across approaches. In particular, some general conclusions are formulated when a relation is found to hold on average across the participating countries/economies and at least (and sometimes only) a couple of countries. In any case, this report is conceived as a generator of hypotheses that warrant further examination in future studies.

### ***Use of advanced statistical methods, including a machine learning technique***

To make the most of the TALIS-PISA link data, this report takes a mixed data and theory-driven approach. The TALIS 2018 conceptual framework (Ainley and Carstens, 2018<sup>[27]</sup>) and previous research findings are carefully considered to inform the analyses and interpret, validate, or contextualise the findings. Each of the following chapters builds on the research literature and presents a theoretical framework that underpins the analyses.

The approach is also strongly data driven insofar as the identification of the teacher and school characteristics and practices that matter for student outcomes is centred around a machine learning technique called "lasso" (see Box 2.1 in Chapter 2 for a presentation). Machine learning techniques have rapidly developed with the recent explosion of "Big Data" (Hastie, Tibshirani and Friedman, 2017<sup>[34]</sup>). They are an attractive tool for analysing data patterns emerging from the many variables collected through the TALIS questionnaires and the many student outcomes measured by the PISA assessment and questionnaire. In particular, lasso can select variables that are highly correlated with the outcome variable even when the number of potential variables is high relative to the number of observations. Lasso regressions are performed in each chapter as a compass guiding the selection of key teacher and school factors related to student achievement, social-emotional skills and gaps in student performance within schools. This OECD report is the first of its kind to apply this machine learning technique to large-scale international education data.

Variance decomposition techniques are applied to measure the share of variance in student outcomes explained by each of the teacher and school factors considered (those highlighted by lasso and by past research). Standard statistical methods are then used to determine the significance and sense of the

relationships between teacher and school factors, and student outcomes. These standard linear and logistic regressions are applied country by country and on average across countries/economies. Finally, quantile regressions are used in Chapter 4 to delve deeper into whether some of the key identified associations vary in some way for students with different competence levels. The interpretation of the findings focuses on the significance and the sign of the regression coefficients. While the size of coefficients are displayed in figures and annex tables, they are not commented in the report for the sake of brevity and due to reservations regarding over-reliance on them.

By investing in several advanced statistical methods, including a machine learning technique, this report seeks to break new ground in extracting maximum relevant information from a complex dataset. More information on the statistical analyses conducted in this report can be found in Annex B.

## Overview of the main findings

### ***Schools make a difference in how students perform, behave and feel***

Schools and their teachers can actually make a difference not only for student cognitive performances but also for a wide range of students' social-emotional outcomes, including student school behaviour, interest in school, self-concept and education aspirations. Differences in school average performances represent a bit more than 30% of the total variance in student performances, irrespective of the subject domain, on average across participating countries and economies. Schools also differ significantly in the way students perceive their classroom climate and their teachers' enthusiasm for teaching – around 15% of the total variance in these outcomes lies between schools on average across countries. There are also significant differences between schools in students' perceptions of the PISA test difficulty and in students' expectations of completing at least a tertiary degree (10% or more of the total variance on average across countries). School differences result from two phenomena that can mutually reinforce or mitigate each other: prior school segregation of students by their academic, socio-demographic or social-behaviour characteristics, and variations in schools' ability to improve student outcomes. Unfortunately, in the absence of a longitudinal design, the TALIS-PISA link data do not allow disentangling both phenomena and quantifying how much of the school differences each of these phenomena account for.

One might think that schools are more likely to differ in student achievement than in student social-emotional development as schools are more traditionally focused on the former. Yet, research conducted in the US context suggests that teacher effects on certain student attitudes and behaviours are similar in magnitude or even greater than teacher effects on student test scores (Blazar and Kraft, 2017<sup>[35]</sup>). Little is known about the way teacher effects aggregate at the school level, i.e. whether they tend to cumulate or cancel each other out within schools, and whether this varies depending on the outcome of interest. The findings from this report may suggest that teacher effects on student social-emotional skills do not cumulate as much as teacher effects on student achievement do. However, there are other more plausible reasons why schools appear to differ more with respect to student achievement than student social-emotional outcomes (based on PISA data). These have to do with the fact that student achievement is better measured than student social-emotional outcomes in PISA. While student performances in each domain are estimated on at least half an hour of test, indicators of student social-emotional development are measured based on one question each.<sup>6</sup> In addition, students' answers to questions about their attitudes, beliefs and self-concept are more likely to suffer from reference bias than students' answers to the PISA cognitive test. For example, PISA 2018 questionnaire asks students to rate themselves on statements such as: "I am a good reader"; "I am able to understand difficult texts"; or "I normally feel happy"; "I normally feel proud", etc. In answering these questions, students must interpret the definitions of reading proficiency or happiness, for example, which likely involves comparing themselves to other people, students from their class and school, in particular. It is likely that students from different schools have

different standards or reference points when answering these questions. In such cases, the differences between schools in students' social-emotional outcomes might well be underestimated.

In any case, the analyses presented in this report can only explain the share of variance in student outcomes that lies between schools as teacher and school factors are all introduced at the school level. TALIS-PISA link data are more likely to provide insights related to student performance for the Czech Republic and Turkey where differences in school average performances represent about half of the total variance in student achievement as opposed to countries, including Australia, Denmark and Malta, where 25% or less of the total variation in student outcomes lies between schools. Cross-country patterns also emerge regarding school differences in student social-emotional development. The Czech Republic and Georgia are consistently among the countries with the largest school differences in student social-emotional outcomes. At the other end of the spectrum, Colombia and Denmark are consistently among the countries showing the smallest school differences (yet still at around 10% of the total variance or above).

The structure of these education systems, in particular the number of education programmes available to 15-year-olds and students' age at first selection, might explain part of the differences resulting from school segregation. For example, the large differences observed in the Czech Republic might be explained by the fact that 15-year-old students can be enrolled in five different education programmes and they are first selected into these tracks at the age of 11. On the other hand, in Denmark, where small differences are observed between schools, the age at first selection is 16 and all 15-year-old students are enrolled in the same education programme – see OECD (2020<sup>[36]</sup>), Figure V.3.2.

### ***Teacher and school factors selected by lasso, a supervised statistical learning method***

Lasso regressions are performed in Chapters 2 to 4 as a compass guiding the selection of key teacher and school factors related to student achievement, social-emotional skills and gaps in student performance within schools. Four teacher and school factors are consistently selected by lasso as key predictors of both student achievement and student social-emotional development: teachers' classroom practices, classroom characteristics, school culture and school leadership. Two teacher and school factors are uniquely selected by lasso as key predictors of student achievement: teachers' use of working time and teachers' well-being and job satisfaction. This selection of key teacher and school factors is established on the overall population of students, teachers and principals surveyed within all countries and economies participating in the TALIS-PISA link. Variance decomposition analysis indicates that these factors selected by lasso explain at least 20% of the variation between schools in student achievement, and at least 10% of the variation in student social-emotional development.

The four teacher and school dimensions highlighted by lasso as important for student achievement across subjects and student social-emotional development represent teacher and school dimensions with direct and indirect effects on student outcomes. The fact that only four out of the 18 dimensions are found to matter across different student outcomes suggests that the relationships between the teacher and school factors are often characterised by reciprocity and interconnectedness. Indeed, most teacher and school factors such as teacher training or teacher collaboration that are not selected by lasso certainly matter for student outcomes, if only indirectly given the reciprocal and interconnected nature of the relationships between the different dimensions.

The teacher and school factors selected by lasso are also highlighted by the research literature as important elements in relation to student achievement and social-emotional development. The relationship between teachers' classroom practices and student achievement as well as student attitudes and behaviours is well established in past research (Blazar and Kraft, 2017<sup>[35]</sup>; Hattie, 2009<sup>[5]</sup>; Le Donné, Fraser and Bousquet, 2016<sup>[24]</sup>; Muijs et al., 2014<sup>[37]</sup>). The importance of classroom characteristics, in particular the classroom's student composition in terms of socio-economic background and ability level echoes what education research finds in relation to peer effects (Carrell and Hoekstra, 2010<sup>[38]</sup>; Gaviria and Raphael,

2001<sup>[39]</sup>; Sacerdote, 2011<sup>[40]</sup>). Similarly, past research also established the link between school-level factors such as school culture and school leadership, and student outcomes, especially academic achievement (Ainley and Carstens, 2018<sup>[27]</sup>; Chapman et al., 2015<sup>[41]</sup>; Hallinger, 2018<sup>[42]</sup>; Hallinger, 2015<sup>[43]</sup>).

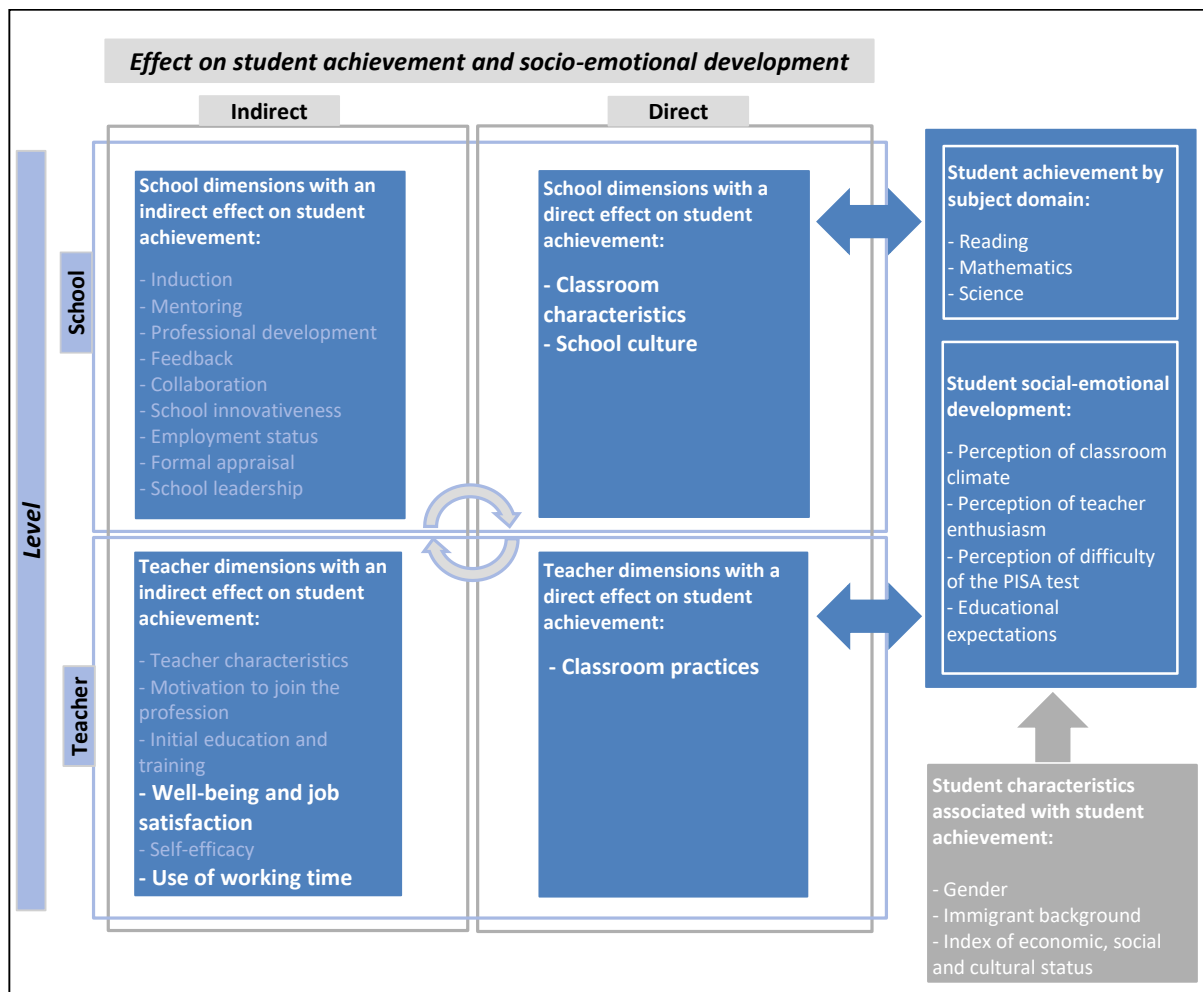
### ***Teacher and school factors that matter for student academic success and social-emotional development***

Standard regressions allow a more detailed focus on specific characteristics and practices of teachers and schools that matter for student achievement and social-emotional development. These factors are: teachers' classroom practices, teachers' use of working time, teachers' well-being and job satisfaction, classroom characteristics and school culture (Figure 1.1). This section describes the findings of Chapters 2 and 3 that hold on average across the TALIS-PISA link countries and economies, and for at least two countries.

What teachers do in the classrooms matters for both student achievement and social-emotional skills, particularly student behaviour in class. Students tend to perform better on average the more class time teachers spend on actual teaching and learning. This finding suggests that students' opportunity to learn is important for student achievement, and this is borne out by the research (Schmidt, Zoido and Cogan, 2014<sup>[44]</sup>). Clearly, students' opportunities to learn are closely linked to the amount of time allocated to academic instruction (Muijs et al., 2014<sup>[37]</sup>) and the link between the quantity and pacing of instruction, and student achievement is also consistently confirmed by past research (Muijs et al., 2014<sup>[37]</sup>). The amount of time students are actively engaged in learning during a lesson is, in turn, highly related to the classroom's disciplinary environment and the teacher's classroom management practices and skills (Muijs et al., 2014<sup>[37]</sup>). When teachers do not actually teach and students do not learn in class, it is usually either due to disciplinary issues or administrative tasks. As previous TALIS findings show, experienced teachers spend more time on actual teaching and learning partly because they teach in less challenging classrooms (OECD, 2019<sup>[29]</sup>). The positive association between the share of class time spent on actual teaching and learning – as opposed to administrative and classroom management tasks – and student achievement may also point to a reverse causal relationship. More disruptive classrooms are more likely to have lower-achieving students, which, in turn, leads to more time spent on other tasks such as keeping order and administrative tasks. TALIS-PISA link results suggest that opportunities to learn are more closely linked to student performance in mathematics than in reading and science.



**Figure 1.1. Teacher and school factors that matter for both student academic success and social-emotional development**



Teacher-student interactions are also related to student behaviour in class. Results show that the more teachers report nurturing good relationships with students, the more students perceive them as enjoying teaching and the better it is for classroom disciplinary climate. In addition, there seems to be clear school patterns of disciplinary climate. There is a high degree of alignment in different stakeholders' perceptions of school climate<sup>7</sup> and consistency in the measures taken by school leaders and school teachers to address disciplinary issues. First, the more teachers report disciplinary issues, the more students report the same. Likewise, the less disciplined the classroom climate is, as reported by students, the more frequently principals report collaborating with teachers to solve classroom discipline problems, and the more time teachers report spending on communication and co-operation with parents. This does not necessarily mean that principals and teachers' remedial measures are detrimental to student behaviour in class. Rather, this likely means that teachers spend more time on these kinds of activities when they feel students need it.

The findings of this report suggest that such vicious circles can be inverted by establishing positive relationships between teachers and students, and promoting a favourable climate for teachers' work well-being. Results show that students tend to find their teachers more interested in their teaching when teachers report lower levels of work-related stress on average in the school. Teachers' job satisfaction also matters for student performance. The more satisfied teachers are with their work environment, the better students tend to perform in school.<sup>8</sup> This finding suggests that teachers' satisfaction with their work

environment can play a role in teachers' attitudes, efforts and commitment, which, in turn, can eventually lead to better performance. But it can also signal the presence of self-enforcing dynamics. Teachers may be particularly satisfied when they work in schools attended by high-achieving students. In turn, these teachers might be particularly committed to helping their academically gifted students progress further. In addition, results signal the presence of differential effects across subjects as teachers' satisfaction with their work environment seems to be more closely related to student performance in science than in reading and mathematics. While this may be explained by the fact that, unlike reading, students mainly acquire their knowledge in science at school, it can also point to the fact that certain requirements regarding the work environment, such as a well-equipped school laboratory, are critical for science teachers to do their work properly.

Teachers and principals are not the sole stakeholders that matter for students' academic and social-emotional skills. Parents and the local community also play an important role in student achievement, especially when it comes to their involvement in school-related activities.<sup>9</sup> Nevertheless, the association between parental involvement and students' academic performance no longer holds after classmates' characteristics are taken into account. Indeed, classmates seem to matter a great deal for student performance and student self-concept. First, the concentration of socio-economic disadvantage among classmates seems to matter for both student achievement and student educational aspirations. As the average concentration of students from socio-economically disadvantaged homes in the classrooms increases, students tend to perform worse academically and be less likely to aspire to tertiary education studies. Since these findings hold while accounting for students' own socio-economic background, it suggests the presence of peer effects. Such concentration of disadvantages may affect the student's cognitive development due to fewer available material learning resources at the school and altered teaching strategies. Students might also be more easily influenced by the lower aspirations of their socially disadvantaged peers or by the shortage of highly educated adults as role models among other peers' parents and, by extension, the local community. Yet, consistent with past PISA-based findings (Raitano and Vona, 2013<sup>[45]</sup>; Rangvid, 2007<sup>[46]</sup>), high-performing students still tend to be less affected than their low-achieving peers by the composition of their classes. This suggests that addressing socio-economic segregation of schools may be beneficial for both increasing student performance at the country level as well as improving equity in educational achievement and opportunities.

In addition, the TALIS-PISA link data point to some encouraging findings. First, the presence of academically gifted students in the classroom seems to be beneficial to students' self-concept in the short term, and to their PISA scores. Indeed, the greater the number of academically gifted students enrolled in the classroom, the more students feel able to succeed in the PISA test. They also end up performing better on average. These findings may signal the presence of academic segregation as high achievers tend to be concentrated in certain schools in most education systems but it can also point to the presence of peer effects. Students' performance can be positively affected by classmates with higher innate ability through an increase in motivation, competition and career aspirations (OECD, 2019<sup>[31]</sup>; Sacerdote, 2011<sup>[40]</sup>).

Second, results show that the larger the peer group, the better it is for student self-concept, both in the short term (perception of improved performance on the PISA test) and the longer term (expectation of completing a tertiary degree). While causality cannot be determined, this might be due to the fact that the larger the class is, the more likely the student is surrounded by peers with various family backgrounds, attitudes, behaviours and aspirations. This creates a richer and more favourable context for the student to grow socially and emotionally. Yet, most likely, the presence of a selection bias is also partly at play. A school's average class size partly captures unobserved characteristics about school intake such as students' social-emotional skills. It is common practice for schools and school systems to implement specific grouping strategies and adjust class sizes to the needs of their students. A previous PISA report found that there was a significant difference of more than three students per class between socio-economically advantaged and disadvantaged schools on average across the OECD, and that such a positive and significant difference was found in 39 education systems (OECD, 2018, p. 89<sup>[41]</sup>).

Finally, although causality cannot be established, a few teacher characteristics and practices have been highlighted as being especially important for student social-emotional development: the level and quality of teacher pre-service training and the way teachers use their working time. First, results show that the greater the number of teachers who hold a master's or a doctorate degree within the school, and the more they felt prepared to teach their subject after their initial training, the more likely students are to expect to complete at least a tertiary degree. This might be because these teachers are better informed on the existing tracks to complete a tertiary degree, or because they represent higher educational aspirations for their students and influence them. Second, the more time teachers spend on extracurricular activities, the more students report that the classroom is disciplined, that the teacher is interested and motivated to teach, and that they expect to complete at least a tertiary degree. Past research found that participation in extracurricular activities can help students develop social-emotional skills such as persistence, teamwork or a stronger sense of belonging at school (OECD, 2020<sup>[36]</sup>) though recent research (Farb and Matjasko, 2012<sup>[47]</sup>) did not seem to have studied the particular effect of teachers' participation in these activities on student outcomes. In addition, the more time teachers spend on marking and correcting student work, the stronger students' self-concept of doing well in the PISA test and, eventually, pursuing tertiary studies. While the findings are slightly less robust on student achievement, they also suggest that the more hours teachers spend on marking and correcting student school work, the better it is for student performance. These findings suggest that spending quality time with students outside of the usual lessons and devoting time to assess student work and indicate progress to students are valuable ways to support student growth.

### ***Teacher and school factors that matter more specifically for equity in performance***

The aim of schools and education systems is for all students to be able to thrive, irrespective of their personal characteristics. This means that teaching practices and teacher-related policies benefit as many students as possible without being detrimental to some of the students – whether the most fragile or most academically gifted – and in a way that achieves the collective optimum. Chapter 4 tackles two distinct policy and research questions on equity in educational achievement:

- Do teacher and school factors matter equally for students with different academic performances?
- How can schools mitigate gender gaps in student performance?

The former section highlighted teacher and school factors found to be important for student performances on average. Could it be that these factors matter for the average student because they actually matter mainly for high-achieving students but not necessarily for low-achieving students? Results presented in Chapter 4 suggest that the answer to this question is no. On average across the countries and economies participating in the TALIS-PISA link, teacher and school factors that matter for average students' performances in reading, mathematics and science also tend to matter for both low and high-achieving students. These factors include the share of class time that teachers report spending on actual teaching and learning, the working hours teachers report devoting to correcting and marking their student work, teachers' satisfaction with the work environment as well as the concentration of academically gifted students in the classroom. In addition, parental and community involvement in school-related activities also matters for all students, regardless of their performance level. This suggests that all these practices could be leveraged to equally support student academic growth, regardless of their initial competence level.

One teacher factor matters specifically for low-achieving students – workload-induced stress. The share of teachers reporting workload as an important source of stress at school is positively associated with better performances for low-achieving students in two out of the three subject domains (reading and mathematics). This result aligns with past research that found that stressful working environments and challenging working conditions can affect the practices of teachers and principals, their work motivation, and even student achievement (Viac and Fraser, 2020<sup>[48]</sup>). Yet, research has associated high levels of stress with deteriorated teacher outcomes such as lower self-efficacy for teaching and lower job satisfaction (Collie, Shapka and Perry, 2012<sup>[49]</sup>). Findings from this report suggest that being collectively

affected by increased workload is not the same thing as being the only teacher in the school feeling stressed due to workload. This might point, generally, to teachers' commitment to their work, which might be particularly beneficial to low-achieving students. Yet, stress can also develop into burnout. Thus, workload-induced stress also signals the need for support for committed and dedicated teachers who feel overwhelmed with the workload.

Equal opportunities for all students also means that differences in students' outcomes are not driven by individual characteristics and circumstances such as gender, socio-economic status or immigration background, everything else being equal. Chapter 4 focuses on gender gaps in student achievement and teacher and school factors that could mitigate them. Two main findings can be drawn from this chapter.

First, boys seem to be more disturbed than girls by classroom disciplinary problems and school organisational issues. As the level of disciplinary issues perceived by the average school teacher increases, the difference in PISA reading scores between girls and boys within schools tends to increase further in favour of girls. And the more often school leaders observe instruction in classrooms and resolve problems with the lesson timetable in the school, the more girls outperform boys in reading. Boys might be more affected by deteriorated learning conditions, as they tend to be exposed to greater peer pressure than girls. They may also more likely be the students disturbing lessons. This echoes several research studies suggesting that, for many boys, it is not acceptable to be seen to be as interested in school work as girls (DiPrete and Buchmann, 2013<sup>[50]</sup>). Boys adopt attitudes that include a disregard for authority, academic work and formal achievement (Salisbury, Rees and Gorard, 1999<sup>[51]</sup>), which might express more acutely when there are practical and organisation disruptions in the school. Overall, boys seem to be less able than girls to stay focused on their schoolwork when disciplinary or practical issues occur in the school. However, the findings also suggest potential measures to support boys in closing the gap with girls: greater involvement and support from parents in school-related activities as well as positive relationships between teachers and students. This suggests that, at the age of 15, boys (more than girls) are in need of support from significant adults – their parents and their teachers – to self-regulate and be achievement-focused.

Second, boys are more likely to perform as well as (or even better) than girls in reading in schools where a culture of student assessment, teacher accountability and appraisal prevails. The more often teachers evaluate their students by administering their own assessment, the smaller the difference in reading performance between girls and boys, in favour of boys. This may suggest that boys benefit from more regular testing as this allows them to better self-regulate and focus on schoolwork. Yet, this might also be due to girls' increased anxiety about frequent testing and induced competition (Devine et al., 2012<sup>[52]</sup>; Gneezy, Niederle and Rustichini, 2003<sup>[53]</sup>; McLean and Anderson, 2009<sup>[54]</sup>; Niederle and Vesterlund, 2011<sup>[55]</sup>). In addition, the more school leaders ensure that teachers feel responsible for their students' learning outcomes and the more often teachers are formally appraised by external individuals and bodies, the better boys perform in reading compared to girls. Giving teachers opportunities to reflect on their teaching practice and finding ways to support low- and middle-achievers, among which boys are overrepresented in reading, could help overcome gender inequalities.

TALIS-PISA link data throw a light on whether students performed better or not when taught by teachers of their gender. Analysis reveals some evidence that a student's performance tends to increase as the share of teachers of their gender in the school increases. This relation is observed for all three subjects in three of the seven<sup>10</sup> countries/economies included in the analyses – CABA (Argentina), the Czech Republic and Turkey – although not on average across the participating countries and economies. These findings support the notion that, at least in certain education systems, teachers may have a bigger influence on students of their gender either by applying distinct teaching practices that suit same-gender students better or by addressing gender stereotypes through acting as role models for these students (Dee, 2005<sup>[56]</sup>).

## What these findings imply for policy

This chapter points out several directions for education practices and policies that would improve student performance and well-being. It includes a particular focus on improving low-achieving boys' reading and student social-emotional skills. These directions draw on and revisit a few policy pointers among the many teacher and school practices and policies put forward in past OECD reports on TALIS 2018 and PISA 2018 results (OECD, 2020<sup>[36]</sup>; OECD, 2020<sup>[28]</sup>).

Once again, it is important to note that, given the cross-sectional design of the survey, the causality and directionality of relationships identified in TALIS cannot be ascertained. Moreover, there is no one-size-fits-all approach to designing policies to improve teaching and learning. When choosing among different policy options, governments must take into consideration the context of their education systems as well as a broad range of evidence to underpin and substantiate policy development. Accordingly, the policy considerations that follow should be interpreted as the OECD's suggestions based on analysis results. They should be considered in each national context according to country-specific challenges and constraints.

### ***Make the most of teachers' time***

An important precondition for quality teaching practices is to make the most of classroom time. Teachers could analyse the way they typically use their class time and, possibly in consultation with the school leader and other colleagues, find ways to reduce the class time spent on administrative tasks and keeping order in the classroom. This might imply finding alternative ways of dealing with administrative tasks and novel ways to improve relationships with students who are more likely to disturb classes. In particular, teachers' involvement in extracurricular activities with their students might be an effective way to improve the disciplinary climate. Time spent with students outside of the regular classroom hours can be particularly positive for establishing and nurturing good relationships with students, which, in turn, are conducive of good conditions for students' cognitive and social-emotional development.

Teachers should also find ways to improve the disciplinary climate of the classroom during regular classes. They could physically arrange the classroom so that students can focus or interact better, monitor their class time closely to manage it better, manage conflicts and allow students to work together and become more autonomous in the learning process. They should find ways to reduce noise in the classroom. They could, for example, use explicit visual codes to build a classroom noise barometer or invite students to experience silence. In their quest for solutions, teachers would also benefit from support by their colleagues, school principal, mentors, inspectors and instructors. They could also participate in professional development activities, focusing on one or several of these classroom management techniques.

Teachers not only need to make the most of their class time, they also need to devote sufficient time to activities that maximise student learning. This report sheds particular light on the importance of marking and correcting student work (for both student achievement and student social-emotional development). It reminds teachers, teacher trainers, school leaders and policy makers of the benefits of regular assessment. It not only provides teachers with an up-to-date picture of student progress, enabling them to determine what subject content and pedagogical approaches to use but it also gives students regular feedback on their progress and ways to improve. Teachers' time spent on summative assessment can be indicative of their engagement in formative assessment. Regular formative assessment creates opportunities for constructive feedback, which helps build a trust-based relationship between teachers and students. Teachers, school leaders and educational authorities could review teacher work schedule to ensure that teachers devote sufficient time to analysing student work and communicating progress to students. Yet, as workload is an important source of stress for teachers, and marking/correcting student work is one of the most time-consuming tasks, education stakeholders could explore ways to use

technology in such a way that teachers spend less time on marking while remaining committed to the formative part of assessment.

While this report highlights some teacher activities that seem particularly beneficial to students' development – participating in extracurricular activities and marking/correcting student work – teachers' workload should not be extended to include more of these activities unless the time they spend on activities such as administrative work, which serve student development less, is reduced.

### ***Promote an achievement-focused culture within schools***

Schools and school systems could promote a culture focused on achievement not only to raise performance but also equity. First, regular use of both formative and summative assessments can be useful for identifying the learning content that students still need to acquire and the learning methods that they could still improve. Students who receive regular feedback from teachers may be better prepared to correct deficiencies in the learning process. Moreover, regular testing of students provide an incentive for students to improve their learning outcomes, especially when the students are boys and when teachers administer their own tests. Such regular tests and feedback can give students a sense of agency, and a belief that they can influence their own learning. It can also strengthen schools' and teachers' sense of responsibility.

Second, school culture should not only put emphasis on the achievement of students but also that of teachers. School leaders can play an active role in continuously fostering teachers' feeling of responsibility over student performance. In turn, this type of leadership and sense of accountability can be particularly helpful in closing the gap between girls and boys by stimulating boys' performances. Likewise, a more frequent appraisal of teachers can be leveraged to promote both efficiency and equity in educational achievement. Formal appraisal by external individuals and bodies, which is considered more objective and less judgemental than appraisal by the school management team or other colleagues who work in the same school, may be particularly effective. Making a judgement and providing feedback to teachers about their competencies and performance is a building block of effective schools and education systems. In its summative form, appraisal is a tool for quality assurance, ensuring that required standards are met or recommended practices followed. Yet, there are risks that the formative function of formal appraisal is too closely associated with high-stakes appraisal for accountability purposes. Teacher formal appraisal could be enhanced by central standards and criteria, an independent appraisal component external to the school, a more formal and standardised process, and possibilities for teachers to appeal where they are doubts about the fairness of the process (OECD, 2013, p. 232<sup>[57]</sup>). Appraisal can also take a more formative emphasis and provide an opportunity for teachers to reflect on their practice, strengths and weaknesses in order to identify areas for improvement and career growth (OECD, 2019<sup>[29]</sup>). PISA 2018 results also find that greater equity can be attained when there is good balance between school autonomy and more centralised accountability measures (OECD, 2020, p. 201<sup>[36]</sup>). Formative teacher appraisal benefits from a non-threatening appraisal context, a culture of ongoing observation, mutual appraisal and feedback within the school, clear individual and collective objectives, simple school-based appraisal tools and supportive school leadership (OECD, 2013, p. 233<sup>[57]</sup>). More policy directions on teacher appraisal can be found in the OECD Reviews of Evaluation and Assessment in Education – see, in particular, Chapter 5 of the report *Synergies for Better Learning* (OECD, 2013<sup>[57]</sup>).

### ***Optimise student grouping and teacher assignments***

Student segregation and teacher sorting across schools have been widely documented in past OECD reports (OECD, 2019<sup>[29]</sup>; OECD, 2018<sup>[4]</sup>). Although this is an important component of inequalities in student achievement and, likely, of inequalities in student social-emotional development, the issue of school segregation is considered to be beyond the reach of this report. Rather, this report examines how

inequalities in student outcomes relate with what happens in the schools. It suggests policy levers that can mitigate such disparities.

First, schools can optimise the way students are grouped within classes in a way that is more profitable to the most fragile students than it is detrimental to the strongest students. Schools should strive to spread out both students with disadvantaged socio-economic background and academically gifted students as equally as possible across classes. This helps address not only disparities in student achievement but gaps in student self-concept, which are both mutually reinforcing.

Second, schools should optimise the assignment of teachers to classes. Students benefit from teachers with varied backgrounds (especially in terms of gender) across subjects and/or across school semesters/years. Variety in teacher backgrounds would allow for a variety of teaching approaches, (biased) beliefs about student ability and interest, and role models for students. Teachers and school leaders might consider inviting inspiring adults with characteristics that are under-represented among the school teaching staff into the classroom. Such interventions, even short ones, have proven to be effective at closing gender gaps in educational achievement, and educational and occupational aspirations (Breda et al., 2020<sup>[58]</sup>; Carrell, Page and West, 2010<sup>[59]</sup>).

### ***Be attentive to teacher job satisfaction and well-being***

Teachers' job satisfaction, well-being and beliefs are inter-related and have an indirect effect on student outcomes. Job satisfaction, which is the sense of fulfilment and gratification that teachers get from working, has a positive impact on teachers, school culture and ultimately on students (Ainley and Carstens, 2018<sup>[27]</sup>). Moreover, job satisfaction also plays a key role in teachers' attitudes, efforts and confidence in their daily work with children (Caprara et al., 2003<sup>[60]</sup>; Klassen et al., 2013<sup>[61]</sup>; Tschannen-Moran and Hoy, 2001<sup>[62]</sup>). Thus, positive job satisfaction may also have an indirect effect on student achievement through enhanced commitment leading to better performance of teachers.

This report suggests that some aspects of teacher well-being and job satisfaction are related to student achievement – teacher satisfaction with their work environment and teacher workload-induced stress. In consultation with teachers, school leaders and educational authorities could review working conditions in order to identify the areas that need to be improved. Such efforts could be especially beneficial in the most disadvantaged schools, whose teachers are most likely to face unfavourable working conditions. The fact that teachers' satisfaction with work environment matters particularly for student achievement in science might point to the importance of the quality of school equipment and resources for practical experiments in science lessons. It could also point to the fact that teachers of scientific domains might be more sensitive to their working conditions as they tend to enjoy more or better job opportunities in their field of work than other subject teachers. Therefore, schools and educational authorities should ensure that teachers have the required infrastructure and materials to deliver their subject lessons.

Teachers must also carefully organise their work and monitor their workload to ensure that the number of hours they work as well as the intensity of their work activities do not exceed critical thresholds. Yet, teachers are not the sole person responsible for their workload. School leaders and educational authorities should also ensure that the demands put on teachers are manageable within the time they have to complete their tasks. They must find balance between teachers' workload and the level of stress it induces. While a controlled dose of stress can be a potent force and reflect a feeling of commitment and dedication, teachers should not go too far and let workload-induced stress develop into burnout. It should also be assessed whether the teacher seems to be the only one in their school who considers workload to be an important source of stress. This might be particularly problematic as it could signal weaknesses in the practices of individual teachers. If other teachers in the school also experience workload-induced stress, it might reflect several things: a common commitment and dedication to the work; a general malfunctioning in the school; or a highly competitive school environment. School leaders, teacher trainers and inspectors could be involved to identify problems and provide support to solve them. In those cases where

workload-induced stress is considered excessive, school leaders and teachers should aim to reduce administrative work through the enhanced use of digital tools or by rethinking and eliminating certain tasks. Administrative tasks are identified as one of the main sources of work stress by both teachers and school leaders (OECD, 2020<sup>[28]</sup>).

### ***Engage with parents to build a positive school culture***

Teachers and school principals could count more often on parents to help them build a positive learning environment in their schools. The family-school partnership can be encouraged through home-based parental support. Parents can be encouraged to discuss education matters with their child, help with homework and supervise their child's progress through education. Schools can also invite parents to interact more often with the school staff by communicating with school personnel, and participating in school decision making and school activities (LaRocque, Kleiman and Darling, 2011<sup>[63]</sup>). Schools can develop well-designed communications strategies to encourage parents to support their child's academic achievement and participate in school-related activities, in particular those parents who may be perceived as estranged from the school system or distrustful of the school. Schools can communicate to parents that their involvement in school allows parents to have a first-hand understanding of the learning environment, learn how to navigate the education system, demonstrate to their child that education is important, and influence their child's behaviour by establishing consistent norms (Grolnick and Slowiaczek, 1994<sup>[64]</sup>). Making the most of parents' involvement can also be a way to increase the school's human or material resources, especially when these are limited. Education authorities could also consider providing teachers and school leaders with training focusing on when and how to encourage parents' involvement in order to create a favourable school environment for students (LaRocque, Kleiman and Darling, 2011<sup>[63]</sup>).

Some schools and educational authorities have conducted very insightful experiments and experiences in creating community hubs, which link the school and the community and include education, health and facilities for all members of the community. More information about how local communities and parents can be mobilised to support schools can be found in Schleicher's report (Schleicher, 2018<sup>[65]</sup>).

### **What these analyses imply for future research**

Exploiting TALIS and PISA data from nine countries and economies, this report has been able to shed some light on significant relationships between teacher and school factors, and student achievement and social-emotional development. Interpretation of the findings presented in the report is necessarily on the cautious side, given the limitations of the survey design. For this reason, this report is designed to put forward hypotheses that should be examined further in future research, whether on a larger international scale to test the generalisability of findings or on a more local field with a more suitable design to obtain more subtle results and/or to get greater insights on the sense and causality of the observed relationships. Accordingly, this chapter concludes with some final considerations regarding suggestions for improvements of future study designs.

In this report, the TALIS-PISA link data are used to contribute to an important goal of education research: determining what teachers' and school leaders' characteristics and practices affect students' cognitive and social-emotional outcomes and how. The TALIS-PISA link data present notable limits in addressing this ambitious yet policy-relevant question of which two are of particular importance. First, the link between teachers and students is only established at the school and not at the classroom level. Second, the data are cross-sectional and consist of a snapshot at a given time of teachers' and school leaders' characteristics and practices, and students' academic and social-emotional skills. This is why, at least in part, the sense of the relationships observed cannot be clarified nor their potential causality link be established.



Two main improvements could be considered for future projects linking TALIS and PISA data to improve understanding of the teaching-learning nexus. The first consists of linking the data from teachers with data from not merely students from the teacher's school who participate in PISA but with data from their own actual students. A possibility would be to propose to countries/economies participating in PISA that they over-sample classes of students enrolled in PISA modal grades (grades attended by at least one-third of PISA-eligible students)<sup>11</sup> and administer TALIS questionnaires to those teachers teaching the main PISA subject domains to PISA-participating students, if not to all of their teachers. While identifying and surveying these target populations may put additional burden on schools in some education systems, such study design would allow for a very good match between the students assessed and surveyed through PISA and the teachers surveyed through TALIS in the PISA-participating schools. As for any other OECD study, collected data from teachers and students would be processed with all necessary protection measures to minimise the risk of re-identification to be used for research purposes and in consultation with key social partners.

A second promising direction for improvement would consist of collecting data from the same students and teachers over time rather than (repeated) cross-sectional data. While longitudinal studies come with some drawbacks – being expensive and challenging insofar as participants need to be enrolled over an extended period in the study, their results are also stronger than those of cross-sectional studies. Student learning and social-emotional skills could be measured at different points of time (at least two points). This would allow for measuring changes in student outcomes over time and relating these changes with teachers' characteristics and practices at a given point of time. If data from teachers are also collected at different time points (during the period they teach the same students for obvious practical and analytical reasons), changes in student outcomes could also be related with changes in teachers' attributes. In comparison to repeated cross-sectional studies (TALIS and PISA are periodic surveys with independent samples for every cycle), longitudinal analysis can be used to make more conclusive findings (both at the individual level and at the aggregate level) than cross-sectional analyses, which are essentially descriptive. For example, by looking at within-student correlations (e.g. the correlation between teachers' working hours spent on assessing students and a student's outcome), one can rule out that stable between-student factors (e.g. student gender, socio-economic status, migrant background) can fully explain the association at stake.<sup>12</sup> Likewise, by looking at within-teacher correlations (e.g. the correlation between a teacher's job satisfaction and student outcomes), one can rule out that stable between-teacher factors (e.g. gender, initial teacher education, employment status, school assignment) can fully explain the association in question. In addition, interested countries and economies could also decide to conduct an experiment between two data collection points to examine the impact of a randomised intervention. It could then be possible to conclude a causal relationship between a given teacher practice and student outcomes.

The Global Teaching InSights (OECD, 2020<sup>[66]</sup>) was the first OECD education project to combine both a classroom-level link and a longitudinal design to describe teaching practices in the classroom and analyse their relationships with student outcomes. It provided very interesting insights about the nexus between teaching and learning. In particular, the study found that social-emotional support and classroom management were significant predictors of student personal interest and self-efficacy towards mathematics in half of the participating countries/economies, even after accounting for students' prior mathematics performance and other background characteristics. However, the outreach of the analysis was most likely limited by the use of small and non-representative samples, among other reasons. Drawing lessons from the Global Teaching InSights and the TALIS-PISA link option, efforts should be continued in this direction to design more valid, reliable and analytically powerful studies linking teachers and their students.

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## Notes

<sup>1</sup> Teacher effect refers to the systematic variation in outcome across students assigned to the same teacher given the teacher's ability to increase students' initial knowledge and skills, which accounts for significant variation in student achievement.

<sup>2</sup> TALIS-PISA link: Teaching and Learning International Survey (TALIS) and Programme for International Student Assessment (PISA) link covers schools that participated in both TALIS and PISA.

<sup>3</sup> In each round of PISA, one subject, among reading, mathematics and science, is tested in detail. The main subject in 2018 was reading.

<sup>4</sup> In Malta, there are only 17 out of the 44 schools that are not single-gender schools (i.e. all students surveyed in the school are same-gender students) and where the within-school differences in performance between girls and boys can be computed. Thus, it is not included in the school-level analysis presented in Chapter 4.

<sup>5</sup> Since Viet Nam does not have data on PISA test scores, it is not included in the analyses presented in Chapters 2 and 4.

<sup>6</sup> The depth of survey questions not only matters for the validity of the instrument in terms of its precision, it also matters for its cross-cultural comparability. Longer questions with many sub-items seem indeed to be a better option to enhance cross-cultural comparability of measurement (Avvisati, Le Donné and Paccagnella, 2019<sup>[70]</sup>).

<sup>7</sup> Analysis conducted on previous TALIS-PISA link data (2012-13) showed that there is also a high degree of alignment between teachers and students' perceptions of teachers' classroom practices (OECD, 2017<sup>[69]</sup>).

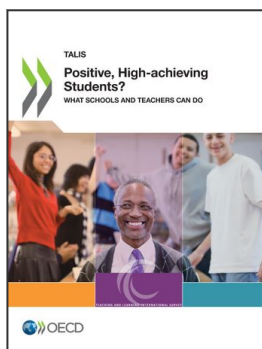
<sup>8</sup> This is consistent with past findings established based on PISA 2015 data, with science as the major domain (Mostafa and Pál, 2018<sup>[67]</sup>). In eight of the 19 countries and economies that participated in the PISA 2015 teacher questionnaire, students in schools with more-satisfied science teachers performed better in science than students in schools with less-satisfied science teachers. Yet, after accounting for students' and schools' socio-economic profile, the relation was significant in fewer countries and economies.

<sup>9</sup> More information regarding how local communities can help schools and their teachers can be found in the report by Schleicher, and in particular in Chapter 2 (Schleicher, 2018<sup>[65]</sup>).

<sup>10</sup> Malta and Viet Nam were not included in this analysis. See Endnotes 3 and 4 above.

<sup>11</sup> This is a national option already offered in PISA, which is quite popular among participating countries and economies.

<sup>12</sup> As shown by an OECD report, the Canadian example has demonstrated the value of linking PISA to a longitudinal follow-up, which can improve our understanding of the social and economic impact of competencies acquired by the school-going population (OECD, 2010<sup>[68]</sup>).



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