



European  
Commission

# Evidence-based Solutions to Teacher Shortages

*EESEE-NESET  
Analytical Report 1/2023*

**EEEN** European  
Expert Network  
on Economics of Education



Education and  
Training

**Please cite this publication as:**

De Witte, K., De Cort, W., Gambi, L. (2023). Evidence-based Solutions to Teacher Shortages. *NESET report*, Luxembourg: Publications Office of the European Union. doi: 10.2766/475647.

**ABOUT EENEE**

EENEE is an advisory network of experts working on economics of education and training. The establishment of the network was initiated by the European Commission's Directorate-General for Education and Culture and is funded by the Erasmus+ Programme. PPMI is responsible for the coordination of the EENEE network. More information on EENEE and its deliverables can be found on the network's website [www.eenee.eu](http://www.eenee.eu). For any inquiries, please contact us at: [eenee@ppmi.lt](mailto:eenee@ppmi.lt).

**ABOUT NESET**

NESET is an advisory network of experts working on the social dimension of education and training. The European Commission's Directorate-General for Education and Culture initiated the establishment of the network as the successor to NESET II (2015-2018), NESSE (2007-2010) and NESET (2011-2014). The Public Policy and Management Institute (PPMI) is responsible for the administration of the NESET network. For any inquiries please contact us at: [info-neset@ppmi.lt](mailto:info-neset@ppmi.lt).

**AUTHORS:**

- **Kristof DE WITTE**, Full Professor KU Leuven
- **Willem DE CORT**, researcher KU Leuven
- **Letizia GAMBI**, researcher KU Leuven

**PEER REVIEWERS:**

- **Miroslav BEBLAVY**, EENEE Scientific Coordinator
- **Dragana AVRAMOV**, NESET Scientific Coordinator
- **Jana HUTTOVA**, NESET Expert Committee member

**LANGUAGE EDITOR:**

- **JAMES NIXON**, Freelance editor

**EUROPEAN COMMISSION**

Directorate-General for Education, Youth, Sport and Culture  
Directorate A — Policy Strategy and Evaluation  
Unit A.4 — Evidence-Based Policy and Evaluation

E-mail: [eac-unite-a4@ec.europa.eu](mailto:eac-unite-a4@ec.europa.eu)

European Commission  
B-1049 Brussels

Contractor:

**PPMI**

PPMI Group  
Gedimino ave. 50, LT - 01110 Vilnius,  
Lithuania

Phone: +370 5 2620338 Fax: +370 5  
2625410

[www.ppmi.lt](http://www.ppmi.lt)

Director: Rimantas Dumčius

# **Evidence-based Solutions to Teacher Shortages**

***EENEE-NESET Analytical Report 1/2023***

*Kristof De Witte, Willem De Cort, Letizia Gambi*

## LEGAL NOTICE

This document has been prepared for the European Commission however it reflects the views only of the authors, and the European Commission is not liable for any consequence stemming from the reuse of this publication. More information on the European Union is available on the Internet (<http://www.europa.eu>).

---

PDF

ISBN 978-92-68-06751-2

doi: 10.2766/475647

NC-05-23-279-EN-N

---

Luxembourg: Publications Office of the European Union, 2023

© European Union, 2023



The reuse policy of European Commission documents is implemented by the Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Except otherwise noted, the reuse of this document is authorised under a Creative Commons Attribution 4.0 International (CC-BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated.

For any use or reproduction of elements that are not owned by the European Union, permission may need to be sought directly from the respective rightholders. The European Union does not own the copyright in relation to the following elements:  
[cover Image(s) © [carloscastilla + 11900361], 2012. Source: [depositphotos.com]

## Table of contents

Table of contents.....	5
Executive summary .....	6
Glossary .....	11
Chapter 1. Introduction .....	12
1.1 Consequences.....	14
1.2 Aim and research questions.....	15
1.3 Methodology .....	16
Chapter 2. Teacher-level interventions .....	18
2.1 Salary and (targeted) financial incentives.....	19
2.1.1. Across-the-board salary increases .....	20
2.1.2. <i>Restructuring compensation</i> .....	22
2.1.3. Performance-based pay .....	24
2.1.4. <i>Targeted financial incentives</i> .....	26
2.2. Workload .....	29
2.2.1. Changing class sizes .....	29
2.2.2. Reducing the number of statutory teaching hours .....	31
2.2.3. Increasing the role of teaching assistants .....	33
2.3. Job security and time-to-tenure .....	35
2.4. Teacher autonomy and the teacher as a professional .....	36
2.5. Using promotional campaigns to attract teachers .....	38
2.6. Promoting gender diversity in the teaching profession.....	41
2.7. Attracting underrepresented groups into the teaching profession.....	43
Chapter 3. School-level interventions.....	46
3.1 School autonomy over the policies to hire and fire teachers.....	46
3.2 Updating recruitment practices .....	48
3.3 School autonomy over teacher remuneration .....	50
3.4 School leadership.....	52
3.5 Induction, support and mentoring .....	54
3.6 Professional development of teachers .....	57
3.7 Networked schools – professional learning communities.....	58
3.8 Collaborative teaching .....	60
Chapter 4. System-level interventions.....	62
4.1 Diversification of career structures .....	62
4.1.1 Introducing a multi-level career structure .....	62
4.1.2 Facilitating task differentiation and mobility between subjects and educational levels .....	64
4.1.3 Promoting hybrid teachers .....	67
4.2 Improving enrolment and retention strategies for initial teacher education (ITE) ..	68
4.3 Alternative paths into teaching.....	70
4.4 Use of ICT and computer-assisted learning.....	72
Chapter 5. Key policy implications and recommendations .....	76
5.1 Teacher-level interventions .....	77
5.2. School-level interventions .....	81
5.3. System-level interventions .....	83
References.....	85

## Executive summary

Teachers play a vital role in our societies by facilitating the process of students' learning and socialisation, and promoting critical thinking (or, more generally, the so-called '21st-century skills') as well as civic engagement. As noted in a Eurydice report (2021, p. 11), teachers 'play the most important role in making education a fruitful experience', and the COVID-19 pandemic has further highlighted the importance of the profession in ensuring that all students have equal opportunities to access high-quality education (Eurydice, 2021). Yet the teaching profession has experienced a decline in its appeal, attracting fewer young people and losing qualified teachers (Eurydice, 2021). Teacher shortages have become a global challenge with complex and pressing implications that require long-term solutions and consistent investments (Eurydice et al., 2018). In the European Union (EU), teacher shortages are a common issue, particularly in primary and secondary education, with more than half of Member States reporting an acute need for qualified teachers (Eurydice et al., 2018).

**Teacher shortages can have significant social implications**, with a higher turnover of teachers occurring in schools with a high proportion of disadvantaged students (i.e. learners with a low socio-economic status (SES)). In particular, evidence shows that, in certain countries, more experienced teachers move away from schools with a more disadvantaged student population, such that these schools attract the less experienced (or novice) teachers. This can perpetuate inequalities, as these schools often require more experienced teachers to address the specific needs of their students. In addition, schools with better infrastructure, organisational culture and management tend to exhibit higher teacher retention rates and attract a more privileged student population, which can exacerbate inequalities. Lastly, a more diverse student population can be experienced as more challenging by teachers. Schools with a more diverse ethnic student population and higher concentrations of low-SES and low-performing students are less likely to retain their teachers, and experience greater shortages of teachers (Gambi and De Witte, 2023). This, in turn, reinforces greater inequalities within and between schools. **The unequal distribution of teacher shortages, with disadvantaged schools being more affected, exacerbates educational inequality among students. This underscores the need to address teacher shortages in order to maintain the quality of education and promote educational equity.**

Given the crucial role that teachers play in providing high-quality education, it is imperative for policymakers to take action to address teacher shortages. While policy directions have been identified at both EU and national levels, policymakers are still in the process of determining the best pathways to achieve these policy goals. It is crucial that action should be taken to ensure that students receive the education they need to succeed in an ever-evolving world.

## Aim and research questions

This report provides a targeted review of possible interventions that could be implemented to address the problem of not having enough qualified teachers to meet the demand for education in a particular region or subject area. For each of these, we seek to investigate the underlying evidence for the intervention, and evaluate its effectiveness in addressing teacher shortages. As we will argue, solving teacher shortages requires a comprehensive

approach that addresses the multiple factors that contribute to the issue: (1) attracting people to the profession; (2) retaining teachers within the profession; and (3) improving teacher quality. Because teacher shortages are a complex issue, there is no 'silver bullet', and interventions to attract and retain teachers and improve teacher quality are required at various levels, i.e. at the level of individual teachers, of schools, and at system level. Each level of intervention focuses on different aspects of the issue.

**The primary objective of this report is to offer evidence-based insights for policymakers seeking to enhance the attraction and retention of teachers and to improve teacher quality.** In the report, we focus on compulsory education but do not distinguish between levels of education, as this allows us to provide a more comprehensive review of interventions that could be applied across different educational levels. Teacher shortages can occur at all levels of compulsory education, and addressing the issue through a broad lens provides insights and solutions that can be adapted to various contexts. We address the following research questions:

1. What are the primary and secondary job attributes that affect attraction to the teaching profession and the retention of teachers?
2. What changes to these job attributes are cost-effective in attracting and retaining teachers?
3. What are effective ways to alleviate the social consequences of teacher shortages?
4. How can teacher shortages be mitigated by the smart allocation of resources?

This report is intended for policymakers dealing with national or regional compulsory education systems, and not as a solution for individual schools or districts. Therefore, policymakers need to carefully consider the effectiveness and efficiency of any of the solutions proposed, and ensure that they are appropriate for the needs of their education system. At this point, it is important to recognise that what might work at the level of an individual school might not be effective or efficient when applied across an education system as a whole. This is known as the 'fallacy of composition', whereby an assumption is made that what works for one part of the system will work for the whole.

### **Methodology**

This study adopts the approach of a targeted literature review. For each intervention at teacher, school and system level, we proceed in two steps. First, we discuss the rationale behind the intervention, and explain the reasons why the intervention is hypothesised to work. To this end, the report relies on policy documents, EU publications, country reports and scientific literature. This step provides a broader understanding of the intervention and how it is expected to address the problem of teacher shortages. The second step involves reviewing the available scientific evidence about the intervention and evaluating whether the intervention is effective or cost-effective. Lastly, it is important to note that there is a lack of evidence regarding the costs of interventions. As a result, expert judgments are made regarding these costs. Thus, we provide an estimate of the costs of implementing the relevant interventions, and their potential impact on the education system.

### **Policy conclusions**

Overall, the report makes clear the overall lack of evidence regarding some of the less obvious and potentially interesting solutions to the problem of teacher shortages. These include promoting the use of hybrid teachers, facilitating task differentiation, or introducing

a multi-level career structure. More research into the effectiveness of these approaches is needed. In line with recommendation of the European Commission report “Investing in our future: Quality investment in education and training” (2022), we suggest experimenting with these measures using small-scale randomised, controlled trials (RCTs), before implementing them on larger scale.

### **Teacher-level interventions**

Chapter 2 focuses on interventions **at teacher level**, which aim to attract and retain high-quality teachers by offering financial incentives such as salary increases and performance-based pay, reducing teachers’ workload, increasing job security and professional autonomy, and addressing beliefs about and the promotion of the teaching career. Overall, our findings reveal that there is strong base of evidence that a few such interventions are highly effective. For a majority of interventions, however, the evidence base is judged to be low-to-medium, while the expected effectiveness is similarly considered low-to-medium. Focusing on the most promising interventions (i.e. those with at least a medium evidence base and medium effectiveness), we can make four recommendations regarding teacher-level interventions.

First, we recommend the use of **targeted financial incentives**, as these appear promising with respect to cost-effectiveness, especially in promoting the retention of teachers in areas of high need. Such incentives include bonuses, salary differentials and deferred retirement plans. Evidence from a policy intervention in Oslo, Norway, shows that a wage premium of around 10% paid to retain teachers in schools with high levels of vacancies (with the premium being lost if a teacher moves to a low-vacancy school) reduces the probability of teachers voluntarily quitting their jobs by approximately 6 percentage points. Furthermore, financial incentives can be an effective tool to promote the retention of teachers in disadvantaged schools, and consequently to foster equity in education. On the basis of a high base of evidence, we rate financial incentives for teachers in disadvantaged schools and hard-to-staff subjects as highly effective, at a medium level of cost. Conversely, we argue that financial incentives for retired teachers or career switchers are potentially less cost-effective, with only a medium-sized evidence base.

Second, based on the available evidence and literature, we recommend closing the salary gap between teachers and similarly educated workers. An **across-the-board salary increase** could be an effective policy measure to tackle teacher shortages by improving both the attractiveness of the profession and the retention of in-service teachers. However, while ‘closing the salary gap with similarly tertiary-educated workers’ is rated as highly effective, it comes at very high costs, based on a medium-sized base of evidence. Across-the-board salary increases do have the potential positive side effect of increasing diversity in the teaching profession with respect to gender and ethnicity, as well as attracting more high-quality teachers by enhancing the profession’s status. However, the evidence for these potential positive side effects is low.

Third, we recommend focusing on combined interventions such as **an across-the-board salary increase, compensated for by a proportional increase in class sizes**. The available evidence suggests that this would be a cost-effective way to increase the attractiveness of the teaching profession, while being budget-neutral. Although this policy has the potential side effect of lower learning gains due to larger classes, higher salaries might serve to attract higher quality teachers (which is a more important input into

educational quality than class sizes). We rate this as a policy measure of medium to low effectiveness with no costs, based on a medium-to-low base of evidence.

Lastly, we recommend exploring the use of teaching assistants to reduce teachers' workload. Teaching assistants can carry out some tasks at a similar level of quality to teachers, but at a lower cost. One particularly promising avenue to reduce teachers' workload while increasing educational quality is the provision of small-scale tutoring by less qualified teaching personnel.

### **School-level interventions**

Chapter 3 of the report highlights interventions that can be implemented **at school level**. These interventions aim to create a supportive environment for teachers by selecting suitable candidates, implementing adequate HR policies, providing autonomy over teacher remuneration, and developing strong school leadership. In addition, programmes for the induction, support and mentoring of new teachers, as well as professional development opportunities and networked schools, can create a positive work environment for teachers and reduce teacher shortages.

The chapter underscores that supporting and valuing teachers as professionals is important in addressing teacher shortages. It argues that well-governed schools attract and retain high-quality teachers, who feel valued and supported by the school community. Overall, we observe that most interventions have only a low evidence base and a low expected impact on attracting and retaining teachers. Focusing on interventions with at least a medium base of evidence and medium effectiveness, we make the following two recommendations.

First, we recommend **implementing longer induction and mentoring programmes, of at least two years**. Induction programmes for new teachers lead to higher teacher retention rates, faster professional development, and enhanced student learning outcomes. The most successful mentorship programmes are those that offer same-subject mentors, regular collaboration and external networking. In addition, providing mentor training and allowing partial release from regular duties can improve the teaching practice of new teachers through the provision of personalised coaching and support.

Second, Chapter 3 also suggests that **stimulating continuous professional development** could be an effective means to increase teacher retention. Professional development activities should have a high content focus, involve active learning, have a sustained duration, include collective participation, and offer coherence and ownership. While research on the area remains limited, it also appears that teacher collaboration, e.g. in professional learning communities, can result in the increased retention of teachers.

### **System-level interventions**

Chapter 4 focuses on **system-level interventions** to mitigate teacher shortages. Such interventions aim to address the broader systemic issues that contribute to teacher shortages. These measures include promoting career diversification via flexible national careers frameworks, task differentiation, enabling mobility between subjects and educational levels, and promoting the use of hybrid teachers (i.e. combining a part-time job as a teacher with a different part-time job). Such interventions require the involvement

of policymakers, government officials and educational leaders in the implementation of effective policies and programmes to mitigate teacher shortages. The chapter goes on to examine the effects of strengthening initial teacher education (ITE) in specific subjects, promoting alternative pathways into teaching, and stimulating the use of ICT and computer-assisted learning. From this analysis, three policy conclusions are drawn.

First, we recommend the promotion of existing initial teacher education programmes. ITE provides a valuable path into teaching, and **the quality of ITE programmes** contributes to the attractiveness of the teaching profession. Thus, in debating whether to professionalise or deregulate teacher education, countries should carefully consider the evidence and retention rates among ITE-educated teachers versus those who receive training via an alternative route into teaching.

Second, countries facing teacher shortages could make use of **alternative pathways** to attract potential teachers, especially in areas of high need, as little difference can be discerned in terms student achievement between teachers who are traditionally trained, versus those who are trained by alternative routes. However, teachers trained via alternative pathways are more likely to leave their school when compared with traditionally trained teachers. Therefore, to combat these higher attrition rates among alternatively trained teachers, recruitment and retaining incentives must be balanced.

Third, we recommend improving the **use of computer-assisted learning (CAL)** in education. In conditions where there is adequate hardware and software, as well as professional teacher development and ongoing technical support, and where CAL is well integrated into the curriculum, its use can increase the efficiency of education by providing teachers with access to a wide range of educational resources and tools, and reducing teachers' workload by automating administrative tasks. Although CAL can be beneficial in supporting student learning in situations where direct teacher instruction is unavailable, it should only be used as a temporary solution to address teacher shortages. This is because teachers have a critical role to play in promoting students' social and emotional development, as well as providing guidance and support that cannot be substituted using CAL.

## Glossary

**Full-time teacher:** a teacher who is employed on a full-time basis, and has a regular teaching load of classes or instructional hours.

**In-service teacher training:** the process by which teachers engage in further education or training to refresh or upgrade their professional knowledge, skills and practices during the course of their employment (UNESCO, 2019).

**Qualified teacher:** a teacher who holds a recognised teaching qualification, such as a degree in education or a teaching certificate, and has met the necessary requirements to teach in a specific subject area or at a particular grade level.

**STEM:** no common, universal understanding of the term 'STEM' exists means across European countries. In the present report, we refer to it as meaning 'Science, Technology, Engineering, Mathematics'.

**Tenured teacher:** a teacher who has been granted job security after a probationary period, and who has the right to due process before being dismissed or disciplined.

## Chapter 1. Introduction

Teachers play a vital role in our societies by facilitating the process of students' learning and socialisation, and promoting critical thinking (or, more generally, the so-called '21st-century skills'<sup>1</sup>) as well as civic engagement. Teachers 'play the most important role in making education a fruitful experience'<sup>2</sup>, and the COVID-19 pandemic has further highlighted the importance of the profession in ensuring that all students have equal opportunities to access high-quality education (Eurydice, 2021). Yet the teaching profession has experienced a decline in its appeal, attracting fewer young people and losing qualified teachers, leading to reported teacher shortages across all of Europe (Eurydice, 2021).

Teacher shortages have become a global challenge with complex and pressing implications that require long-term solutions and consistent investments (Eurydice et al., 2018). Teacher shortages are a common issue across the European Union (EU), particularly in primary and secondary education, with some Member States reporting an acute need for qualified teachers.<sup>3</sup> Teacher shortages may be reported through various methods, such as reports by authorities which cite statistics on unfilled vacancies, as well as data on the percentage of schools reporting recruitment difficulties, or feedback from teachers' unions. In the Belgian Community of Flanders (Belgium FL), and in countries such as the Czech Republic, Denmark, Estonia, France, Ireland, Latvia, the Netherlands, Portugal and Sweden are among those reporting the need for qualified teachers.<sup>4</sup> The Netherlands, for example, currently faces a shortage of 2,900 teachers in primary education, and 9,100 teachers at secondary level (each expressed in terms of full-time equivalents). In the German state of North Rhine-Westphalia, public schools have a reported 4,000 unfulfilled vacancies. Latvia also experienced a deficit of 2,000 full-time teaching positions prior to the start of the 2022/2023 academic year. In Ireland, a recent survey showed that 91% of public schools had experienced difficulty in recruiting teachers during the previous six months (Teachers' Union of Ireland, 2022). Teacher shortages are particularly noticeable in certain subjects, especially STEM subjects. Belgium's French-speaking Community (Belgium FR), Bulgaria, Czech Republic, Germany, Estonia, Croatia, Hungary, Lithuania, Latvia, the Netherlands, Poland, Slovakia and Slovenia, all report shortages in these subject areas. Furthermore, many Member States face a lack of foreign language teachers (Belgium FR, Belgium FL, Bulgaria, the Czech Republic, France, Hungary, Croatia, Latvia, Portugal and Poland) and native language teachers (Bulgaria, Czech Republic, Estonia and Latvia).

---

<sup>1</sup> 21st-century skills include collaboration, communication, digital literacy, citizenship, problem solving, critical thinking, creativity and productivity. The term '21st-century skills' is used to denote abilities that are more relevant to the current economic and social landscape, which differs from the industrial mode of production that characterised the previous century (Van Laar et al., 2017).

<sup>2</sup> Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'on achieving the European Education Area by 2025'. 30.09.2020 COM(2020) 625 final, p. 9.

<sup>3</sup> We use the term 'qualified teacher' to mean a teacher holding a recognised teaching qualification, such as a degree in education or a teaching certificate, who has met the necessary requirements to teach in a specific subject area or grade level. In the remainder of the report, we use the term 'qualified teacher' and 'teacher' interchangeably, unless explicitly mentioned.

<sup>4</sup> The data presented in this report are given by way of example and are subject to availability. They illustrate the various and heterogeneous situations across Europe.

The shortage of teachers in many countries may be attributed to a combination (and an imbalance) of supply and demand factors (for a review of this, see Santiago, 2002). Specifically in Europe, demand for teachers is higher due to an increase in student enrolment in certain countries (e.g. between 2014 and 2020, a rise of 16% students in upper-secondary education in the Netherlands; +11% Estonia; +9% in Sweden; +8% in Poland; and +6% in Spain). A rise in early childhood education has also increased demand for teachers (e.g. between 2014 and 2020, enrolments almost doubled in Ireland, and rose by +46% in Cyprus; +15% in Germany; +15% in Austria; +11% in Lithuania). Furthermore, changes in education policies or curricula can create new demands for teachers with specific skills or qualifications, leading to shortages in certain subject areas. In addition to this, reductions in class sizes (e.g. due to more specialised curricula, fewer students per class in rural areas, or policy interventions) have also resulted in a higher demand for teachers. For example, between 2014 and 2020, the pupil-teacher ratio decreased from 15.4 to 13.8 in Belgium; from 11.8 to 9.9 in Greece; from 11.1 to 8.5 in Luxembourg, and from 16.4 to 12.6 in Poland).<sup>5</sup> Demand for teachers is also rising due to the need to urgently integrate a large number of incoming child refugees from the war in Ukraine. Another contributing factor is the challenge of retaining teachers, especially in the wake of the COVID-19 pandemic, which led to increased absenteeism due to stress, workload and the demands of distance learning (Gambi & De Witte, 2023). This absenteeism has further accelerated teacher shortages.

On the supply side, the low attractiveness of the teaching profession has resulted in a lower supply of teachers, which is evident from the low levels of enrolment in initial teacher education programmes in some countries (e.g. Education and Training Monitor, 2022; Statistics UK, 2023). This also provides an indicator for the persistence of such shortages. In 2017, around 72% of the nearly 6 million people in the EU working as teachers were women – suggesting that the profession is also not attractive to males (European Parliament, 2020). Moreover, the supply of teachers is further reduced due to the ageing teacher labour force (European Commission, 2022). Lastly, low retention within the teaching profession reduces the supply of teachers because it leads to a high turnover rate and a smaller pool of (experienced) teachers.

These factors highlight the need for policy solutions to address teacher shortages and ensure that all students have access to high-quality education. However, while similarities exist between Member States in terms of the factors contributing to teacher shortages, the specific combinations of these factors may differ and be unique to each individual country. In various Member States, including Bulgaria, Belgium and Poland, a considerable number of teacher graduates end up pursuing alternative professions. Moreover, in some countries (e.g. Slovakia, Latvia), schools struggle to retain young teachers, due to low salaries or limited opportunities for career advancement, while in other countries (e.g. Belgium, Germany, Hungary, Netherlands, Poland) rates of teacher burnout and stress are high. In some cases, there may be a lack of qualified individuals in specific subject areas such as STEM, or in certain geographical areas.

Despite these differences, **it is clear that a more balanced policy approach is needed that addresses both teacher recruitment and retention, in order to mitigate the impact of the ageing teaching population. This requires taking into account the**

---

<sup>5</sup> [https://ec.europa.eu/eurostat/databrowser/view/EDUC\\_UOE\\_PERP04/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/EDUC_UOE_PERP04/default/table?lang=en)

**needs and concerns of both new and experienced teachers, as well as developing effective strategies to attract and retain teachers in specific subjects and geographical areas.**

### **1.1 Consequences**

**Teacher shortages can have significant social implications.** As a result of teacher shortages, there is a higher turnover of teachers in schools with a high proportion of disadvantaged students (i.e. learners with low socio-economic backgrounds). In particular, evidence shows that in some countries, more experienced teachers move away from schools with a more disadvantaged student population, leaving these schools to instead attract less experienced (or novice) teachers (see, for example, in Belgium FL: Gambi and De Witte, 2023; in Norway: Falch, 2010, 2011). This situation can perpetuate inequalities, as these schools often require more experienced teachers to address the specific needs of their students. In addition, schools with better infrastructure, organisational culture and management tend to have higher teacher retention rates and attract a more privileged student population, which can further exacerbate inequalities (Gambi and De Witte, 2023). Lastly, a more diverse student population may be experienced by teachers as being more challenging – as observed in a literature review by Borman and Dowling (2008), which found that schools with a more diverse ethnic student population and higher concentrations of low-SES and low-performing students were less likely to retain their teachers, and tend to experience greater shortages of teachers (Gambi and De Witte, 2023). This in turn reinforces greater inequalities within and between schools.

**The unequal distribution of teacher shortages – with disadvantaged schools being more affected – exacerbates educational inequality among students.** In particular, high-SES) parents may be better equipped to deal with teacher shortages than their low-SES counterparts, for several reasons. First, high-SES parents may have more resources to invest in their children’s education, such as hiring private tutors (Bray, 2021; Dang & Rodgers, 2008; De Cort & De Witte, 2023a) or enrolling their children in extra-curricular activities that can supplement their learning (Maldonado, De Witte & Declercq, 2022). Low-SES parents do not possess the same level of resources or financial stability, making it more difficult for them to provide additional support to their children's education. Second, high-SES parents may possess more social and political connections, which could give them greater access to knowledge about the education system and how to navigate it effectively, giving them an advantage in securing good teachers and schools for their children. Third, low-SES families may face more significant challenges outside the classroom, such as the lack of an adequate place to study if children are sent home due to teacher absenteeism, or a poor internet connection in the event of distance learning. These challenges may compound the negative effects of teacher shortages, making it even harder for low-SES families to deal with the consequences (Maldonado & De Witte, 2021; De Witte & François, 2023). **This underscores the need to address teacher shortages, both to maintain the quality of education and to promote equity in education.**

Quality of teaching is crucial to ensuring that students achieve academic success, especially for those with low SES. A detailed outline of what teacher quality consists of is beyond the scope of this report. It cannot be reduced to a fixed concept or certain personal characteristics, but is rather a case of ensuring that the right person is in the right role. We do, however, stress its importance, as teachers are found to be the most important

input into learning gains as measured by standardised tests, as well as for behavioural outcomes such as suspensions, teen pregnancy and unemployment, albeit that there is a great deal of heterogeneity in teachers' ability to achieve these outcomes (Chetty et al., 2014; Gilraine & Pope, 2021). Any policy to tackle teacher shortages must ensure that teaching quality is not harmed and, if possible, is improved. With respect to learning outcomes, the consequences of teacher shortages are serious. Shortages affect the learning performance of students and correlate with lower PISA scores in mathematics, reading, and science (OECD, 2020; De Witte & Iterbeke, 2022). Evidence that teacher shortages have a negative impact on students' learning outcomes is provided by recent research by Gambi and De Witte (2023). Their study identified a link between school test scores and administrative data on teacher shortages, such as absenteeism and unfilled vacancies (used as a proxy for teacher shortages). The study found that a one percentage point increase in unfilled vacancies is associated with a decrease of -0.04 SD in native language and -0.05 SD in maths proficiency. **This finding highlights the potential for teacher shortages to worsen the challenges faced by education systems, such as the declining trend in educational achievement, accumulating deficits in learning due to COVID-19 school closures and quarantines, and the existing large inequalities in test scores between students and schools.**

Given the crucial role teachers play in providing a high-quality education, it is imperative for policymakers to take action to address teacher shortages. While policy directions have been identified at both EU and national levels, policymakers are still in the process of determining the best pathways to achieve such policy goals. It is crucial that action is taken to ensure students receive the education they need to succeed in an ever-evolving world.

## 1.2 Aim and research questions

The present report provides a targeted review of possible interventions that could be implemented to address the problem of not having enough qualified teachers to meet the demand for education in a particular region or subject area. We seek to investigate the underlying evidence for each intervention, and to evaluate its effectiveness in addressing teacher shortages. As we will argue, solving teacher shortages requires a comprehensive approach that addresses the multiple factors that contribute to the problem: (1) attracting people to the profession; (2) retaining teachers in the profession; and (3) improving teacher quality. Because teacher shortages are a complex issue, there is no 'silver bullet', and interventions to attract and retain teachers and improve teacher quality are required at various levels, i.e. at the level of individual teachers, in schools, and at system level. Each level of intervention focuses on different aspects of the problem.

**At teacher level**, interventions aim to attract and retain high-quality teachers by offering financial incentives such as salary increases and performance-based pay, reducing workload, increasing job security and professional autonomy, as well as promoting and addressing beliefs regarding a career in teaching. **At school level**, interventions aim to create a supportive environment for teachers by selecting suitable candidates, implementing adequate HR policies, providing autonomy over teacher remuneration, and developing strong school leadership. In addition, programmes for the induction, support and mentoring of new teachers, as well as professional development opportunities and networked schools, can create a positive work environment for teachers, and reduce

teacher shortages. **At system level**, interventions aim to address the broader systemic issues that contribute to teacher shortages. Such interventions can include promoting career diversification via flexible national careers frameworks, task differentiation, mobility between subjects and levels of education, and promoting the use of hybrid teachers (i.e. combining a part-time job as a teacher with a different part-time job). These interventions require the involvement of policymakers, government officials and educational leaders in implementing effective policies and programmes to mitigate teacher shortages. Furthermore, strengthening initial teacher education (ITE) in specific subjects, promoting alternative pathways into teaching, and stimulating the use of ICT and computer-assisted learning (see Section 4.4) can also mitigate teacher shortages.

By implementing targeted interventions at each level, it is possible to attract and retain high-quality teachers, create a supportive work environment, and improve quality and equity in education. This report examines different levels of interventions for tackling teacher shortages, and provides insights into how education systems can better attract and retain high-quality teachers.

**The primary objective of this report is to offer evidence-based insights for policymakers seeking to enhance the attraction and retention of teachers, and improve teacher quality.** In the report, we focus on compulsory education, but do not distinguish between education levels, as this allows a more comprehensive review of interventions that can be applied across different levels of education. Teacher shortages can occur at all levels of compulsory education, and addressing the issue through a broad lens provides insights and solutions that can be adapted to various contexts. We address the following research questions:

1. What are the primary and secondary job attributes that affect attraction to the teaching profession and the retention of teachers?
2. What changes to the job attributes are cost-effective in attracting and retaining teachers?
3. What are effective ways to alleviate the social consequences of teacher shortages?
4. How can teacher shortages be mitigated by the smart allocation of resources?

### 1.3 Methodology

In this report, we adopt the approach of a **targeted literature review** (or focused literature review; Munn et al., 2018). This research method involves a focused search for relevant literature on a specific topic. In a targeted literature review, the focus is on a specific set of research questions or interventions, and the search is limited to a selected number of sources. Contrary to a systematic literature review (e.g. Ansyari, Groot and De Witte, 2023; Carrizosa & De Witte, 2023), the approach involves identifying and reviewing literature that is directly relevant to the research question or interventions of interest, rather than attempting to cover all available literature on the topic (Munn et al., 2018). As is the case in the present report, the approach of a targeted literature review is often used when a specific research question or intervention needs to be evaluated, and there is a need for a more focused and efficient review of the available literature.

For each intervention at teacher, school and system level, we proceed in two steps. **First, we discuss the rationale behind the intervention, and explain the reasons why**

**the intervention is hypothesised to work.** To this end, the report relies on policy documents, EU documents, country reports and scientific literature. This step provides a broader understanding of the intervention and how it is expected to address the problem of teacher shortages. It should be noted, however, that it is beyond the scope of the report to provide a comprehensive and systematic analysis of examples in European countries. The examples provided are solely intended to illustrate the relevance of a given intervention.

**The second step involves reviewing the available scientific evidence on the intervention, and evaluating whether the intervention is effective or cost-effective.** To do so, the report relies on academic literature, as made available by the Web of Science and in official reports from the EU, OECD, World Bank and UNESCO. As keywords, we used 'teacher shortage' in combination with the name of the intervention. In terms of its inclusion criteria, where possible, the search focused on papers offering causal inference<sup>6</sup>, as these provide the best way to measure the effectiveness of interventions. In the absence of identification strategies being used that allow for causal inference, we make the underlying correlational and/or qualitative evidence base explicit. Hence, this step provides an empirical assessment of the intervention's effectiveness and its potential impact on the problem of teacher shortages.

Lastly, it is important to note that there is a lack of evidence regarding the costs of interventions. As a result, expert judgments are made in relation to the costs of the interventions mentioned (see Table 1, p. **Error! Bookmark not defined.**). This step provides an estimate of the costs of implementing the interventions, and their potential impact on the education system.

This report is intended for policymakers dealing with national or regional compulsory education systems, and not as a solution for individual schools or districts. Therefore, policymakers need to carefully consider the effectiveness and efficiency of any of the solutions proposed to ensure that they are appropriate for the needs of their education system. At this point, it is important to recognise that what might work at the level of an individual school might not be effective or efficient when applied across an education system as a whole. This is known as the 'fallacy of composition', whereby an assumption is made that what works for one part of the system will work for the whole.<sup>7</sup>

---

<sup>6</sup> Causal inference is widely used in the field of policy evaluation. It refers to the process of determining whether a particular intervention has a causal impact on an outcome of interest. Several approaches can be taken to establish causal inference, including randomised controlled trials (RCTs) and natural experiments, using statistical methods such as matching, instrumental variables, regression discontinuity and difference-in-differences analysis (for a review of causal inference and related techniques, see Abadie & Cattaneo, 2018).

<sup>7</sup> One example of this is the belief that lowering class sizes is a solution for teacher shortages, as some top schools have successfully implemented this approach. However, this is not a viable solution for the entire education system, not just because it would be costly, but also because it would require a significant increase in the number of teachers needed to accommodate smaller classes.

## Chapter 2. Teacher-level interventions

This chapter focuses on job attributes (i.e. those characteristics or features of a job that define what it entails and what is required of the person who performs it). These are essential to consider because they impact teachers' job satisfaction, motivation, retention, health and well-being. Prioritising job attributes can enable a supportive work environment that attracts and retains top talent, ultimately leading to improved organisational success and outcomes. In the case of teaching, job attributes such as remuneration/financial compensation, workload, class size, statutory teaching hours, autonomy and support all have the potential to impact teacher job satisfaction and retention. Teachers who feel undervalued, overworked or unsupported may experience burnout and be more likely to leave the profession, contributing to teacher shortages and negatively affecting student outcomes (Carrizosa & De Witte, 2023). Furthermore, job attributes are crucial in attracting and retaining talent. When the education system provides desirable job attributes, it can attract and retain a pool of qualified and motivated candidates.

The literature on teachers' preferred job attributes is extensive. Evidence of influence on teachers' job choices exists for at least 35 different job attributes (Burge et al., 2021). Much of this research uses Likert scales in surveys to assess how 'important' certain job attributes are in teachers' career choices (be it becoming a teacher or leaving the profession), or what attributes they consider to be most important (Burke et al., 2015). The results are relatively consistent across studies: Teachers and potential teachers mostly want a higher salary, a lower workload (for example by having fewer pupils per class, a lower administrative burden or better pupil behaviour), as well as a higher social status and better recognition (Burge et al., 2021; Carlo et al., 2013; Kyriacou et al., 2003; Manthei et al., 1996; OECD, 2005; Saks & Soosaar, 2016). While offering important insights, these approaches do not allow the evaluation of cost-effectiveness, as they do not quantify the relationship between costs and their effectiveness, which can lead to problematic policy recommendations (see, for example, Section 2.2.1. on reducing class sizes) (Johnston, 2021). This limits their usefulness to policymakers under tight budget constraints who are interested in what changes to teachers' job attributes would be most cost-effective in increasing job satisfaction among teachers and potential teachers (i.e. changes to a few 'less important' job attributes, such as autonomy and task diversification, might have a larger effect on teachers' job satisfaction at the same cost than, for example, a salary increase).

In this chapter, we go beyond which job attributes are 'most important' to focus instead on what changes to teachers' job attributes might be most cost-effective in attracting and retaining teachers. The most important source of evidence in this case are policy evaluations. Given the limited number of these, we supplement them with additional evidence on the importance of various job attributes, as measured by discrete choice experiments. This 'stated preference' method can rigorously quantify preferences for certain attributes by asking respondents to choose repeatedly between hypothetical alternatives that differ with respect to a list of attributes. For example, rather than finding that 'a higher salary' is 'more important' than 'smaller classes', discrete choice experiments can quantify that an x% increase in salary is valued equivalently to a y% decrease in class size.

Before considering what could make the teaching profession more attractive, it is useful to consider what already makes teaching an attractive profession. There is a growing body of literature on what motivated teachers in initial teacher education, as well as in-service teachers, to enter the profession. The reasons that are usually cited as most important are both altruistic (e.g. contributing to society, supporting young people) and intrinsic (e.g. a passion for teaching, for the subject matter and for working with children) (Fray & Gore, 2018; OECD, 2019b; Struyven et al., 2013; Thomson et al., 2012). These results are encouraging, as they signal that teachers are intrinsically motivated to work hard even in the absence of strong performance incentives or strict evaluation. Perceived teaching abilities, or 'self-efficacy', are also an important motivator to become a teacher (Fray & Gore, 2018; Struyven et al., 2013; Thomson et al., 2012). Lastly, the extrinsic factors most often cited as attractive aspects of a teaching career include long holidays, the ability to balance work and family responsibilities due to a flexible schedule outside of teaching hours, and job security (Fray & Gore, 2018; OECD, 2019b; Struyven et al., 2013; Thomson et al., 2012).

The remainder of Chapter 2 is structured as follows. Section 2.1 discusses salary and targeted financial incentives as potential interventions. Salaries have been identified as a critical factor affecting the recruitment and retention of teachers. Across-the-board salary increases might attract new teachers, but may not be the most cost-effective measure due to their high cost. Performance-based pay and targeted financial incentives, on the other hand, can provide an additional incentive for teachers to remain in the profession and improve their performance. This section will also discuss the benefits and drawbacks of restructuring compensation, which involves increasing the proportion of compensation that is tied to student outcomes or other performance measures. This approach might increase teachers' motivation and improve performance, but it also raises concerns regarding the reliability and validity of performance measures. Section 2.2 addresses teacher workload, which has been identified as a significant factor contributing to teacher stress and burnout. The section examines the potential impact on teacher workload of reducing class sizes and statutory teaching hours, and increasing the role of teaching assistants. Section 2.3 focuses on job security and time-to-tenure, which can be a critical factor in retaining high-quality teachers. The section will explore the relationship between job security and tenure and teacher retention. Section 2.4 discusses teachers' autonomy and the teacher as a professional. Providing teachers with autonomy over their work and emphasising their professional status has been identified as a potential strategy for retaining high-quality teachers. Section 2.5 will examine the potential of addressing behavioural barriers and enhancing teachers' status as interventions to mitigate teacher shortages. By addressing negative perceptions of teaching as a profession and promoting teachers as professionals, the status and attractiveness of the teaching profession can be improved. Lastly, Section 2.6 provides an overview of ways to encourage diversity in teaching, in terms of gender and attracting members of minority groups.

## **2.1 Salary and (targeted) financial incentives**

Earning a salary is one of the most important reasons why people work. While most (potential) teachers are highly intrinsically motivated, salary remains important in their choice of career. Offering financial rewards is expected to make the teaching profession

more attractive to potential teachers who might otherwise have pursued other career paths. When salaries and benefits for teachers are competitive with those of other professions, more people may be interested in becoming teachers, which could help to address the teacher shortage. Moreover, financial incentives can also help in retaining current teachers who may be considering leaving the profession due to low pay or other factors. By offering financial rewards such as higher salaries, bonuses or other benefits, schools can incentivise teachers to stay within the profession, thus reducing the number of vacancies to be filled.

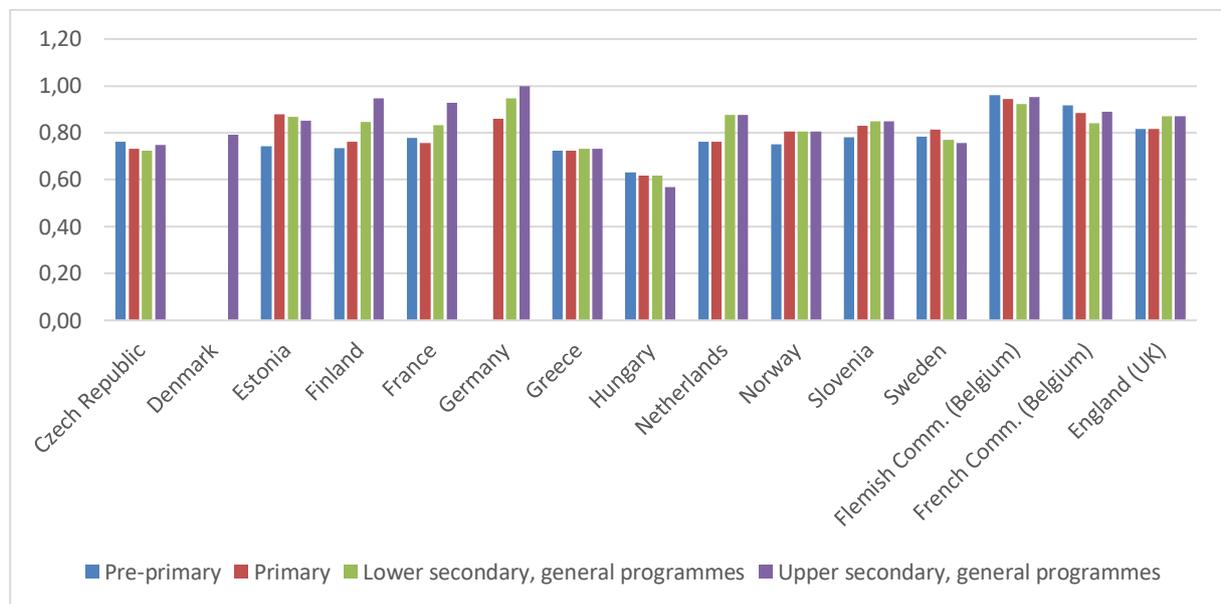
This section discusses the available evidence on the cost-effectiveness of various types of financial incentives in tackling teacher shortages. Each of its subsections refers to centralised changes in teacher remuneration that would apply to all schools within an education system (though possibly differently, for example with respect to the number of disadvantaged students). An alternative strategy would be to give schools the autonomy to decide how much to pay different teachers, an option discussed in Section 3.3.

### **2.1.1. Across-the-board salary increases**

**Rationale.** A higher salary is considered by (potential) teachers as one of the most effective measures to increase the attractiveness of the teaching profession to both potential and in-service teachers (Burge et al., 2021; Carlo et al., 2013; Guarino et al., 2006; Kyriacou et al., 2003; Manthei et al., 1996; Saks & Soosaar, 2016). A higher salary might be particularly effective at attracting academically talented students, students from minority backgrounds and men (OECD, 2018). Despite recent nominal salary rises in multiple EU countries, including Austria, Bulgaria, Czech Republic, Ireland, Lithuania (+30% in the last five years), Romania and Sweden, and upcoming increases in Estonia (+24% in 2023), Slovakia (+8.5%), it has been questioned whether teacher salary levels are sufficiently appealing to attract individuals of high ability to the teaching profession, as in most European countries, teachers' actual wages lag behind those of other tertiary-educated workers. In this regard, **the term "teaching penalty" has been introduced by scholars to describe the wage gap that exists for individuals in teaching professions compared with other occupations with similar requirements and qualifications** (Allegretto et al., 2008). Figure 1 shows teacher salaries relative to the earnings of other tertiary-educated workers for a list of EU education systems. On average, primary school teachers are paid 20% less than a typical tertiary-educated worker in high-income countries, while secondary school teachers receive 10–15% less than professionals with similar qualifications (OECD, 2016). There are some exceptions to this teaching penalty, such as in Lithuania and Portugal for teachers at all levels of education, as well as in the Flemish Community of Belgium, and in Finland for teachers at upper-secondary level (OECD, 2022). It should be noted that these figures originate from a period with low inflation, such that the picture might look even worse today. Lastly, raising salaries offers the added advantage of increasing the profession's social status and signalling the value a society attaches to education (Dolton et al., 2018; Hoyle, 2001; OECD, 2020; De Witte and Iterbeke, 2022). From the perspective of fairness, raising teachers' salaries can be justified by enormous value they add to the well-being of individuals and to national economies (see, for example, Angrist et al., 2021; Hanushek & Woessmann, 2020; Patton 2016).

But while an across-the-board salary increase might be an effective way of tackling teacher shortages that also offers the added benefit of attracting a different population of potential teachers, it might also be **one of the most expensive policy measures**, as teachers' salaries are by far the largest components of educational spending (OECD, 2016). The attractiveness of this policy measure would depend on how sensitive (potential) teachers are to salary increases in their labour market decisions, and how salary increases affect educational quality (for example, by increasing teachers' motivation or attracting more talented persons into the profession). Moreover, other external political factors such as scarce budgets, the complexity of designing a pay raise or political, might also hinder an across-the-board salary increase.

Figure 1. Actual teacher salaries relative to earnings for other tertiary-educated workers.



Source: OECD (2022). Education at a Glance. Adapted from Table D3.2. Teachers' and school heads' actual salaries relative to earnings of tertiary-educated workers (2021)

**Evidence. The academic literature provides some evidence regarding the causal relationship between financial rewards (in the form of teachers' wages) and staff turnover.**<sup>8</sup> In particular, Hendricks (2014) suggests that a 1% increase in teachers' wages leads to a decrease in teacher turnover of 0.16 percentage points. In addition, wage elasticity (i.e. the degree to which the quantity of labour supplied changes in response to a change in wages) is largest for less experienced teachers, and decreases rapidly until it disappears for teachers with around 19 or more years of experience, suggesting that increases in the base wage that are targeted at less experienced teachers would be more cost effective than general wage increases in reducing turnover (Hendricks, 2014). Zarkin (1985) estimates that a 20% increase in the wages of teachers in secondary education would induce a 14% increase in the supply of secondary school teachers, drawing on the reserve pool of teachers who are certified but not working. On the basis of a discrete choice experiment among English teachers, Burge et al. (2021) estimate that a 5% salary increase would lead to a 5% increase in retention at teachers' current schools. However, this study

<sup>8</sup> We use "teacher turnover" to refer to both recruitment and retention.

does not consider how such increases would affect teachers' decisions to stay in the teaching profession as a whole. Other, more targeted measures are likely to be more cost-effective. It must be noted that these studies are specific to their context and that their identification of a causal relationship is not perfect. Existing research thus clearly suggests that there is a positive relationship between teachers' salaries and the supply of teachers, but that uncertainty surrounding the precise relationship (as well as uncertainty with regard to side effects such as increasing teacher quality and diversity) make it impossible to say whether across-the-board salary increases are a cost-effective policy measure.

**In summary, the available evidence points to across-the-board salary increases being an effective policy measure in tackling teacher shortages. However, whether this is the most cost-effective policy measure remains uncertain, partially because its potential positive effect on educational quality is unclear. With respect to cost-effectiveness, targeted financial incentives appear more promising (see subsection 2.1.4).**

### ***2.1.2. Restructuring compensation***

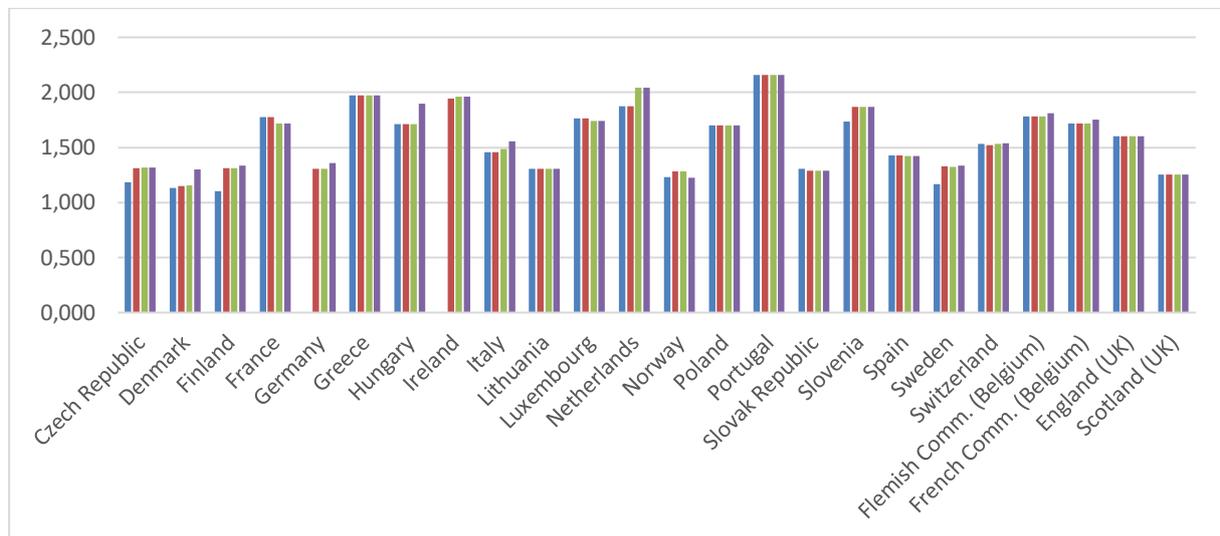
**Rationale.** Aside from increases in salaries, countries can also consider restructuring compensation. There are several different ways in which remuneration schemes can be restructured to maximise the supply of (quality) teachers without increasing spending. Below, we discuss two of the most important components for which we have empirical evidence – pay progression and retirement benefits – but others can also be considered (including holidays and other forms of compensation, such as discounts on cultural events).

One option is to change the distribution of salary across a teacher's working career. A higher starting salary with lower growth in salary could make the profession more attractive to starting (and potential) teachers, with a potential cost in terms of retaining more experienced teachers (also known as 'front-loading compensation', which in the US has been found to correlate positively with student achievement (Grissom & Strunk (2012))). Restructuring compensation without increasing total compensation always implies a trade-off, so countries must aim to find some optimal balance that maximises the supply of teachers. As can be seen in Figure 2, wide variation exists between EU countries in terms of the potential for growth in teachers' salaries, with the ratio between peak salary and starting salary being almost twice as large in some countries. It seems unlikely that teachers' preferences differ this much between countries, which suggests that some countries could improve their supply of teachers by adopting a more attractive salary scale. Compressed pay scales might also offer an additional advantage: organisations with smaller salary gaps among employees can experience increased trust, better communication, and stronger solidarity among colleagues (OECD, 2022). The political power of senior teachers might be one reason why teachers' salaries are too back-loaded, i.e. too low for beginning teachers and too high for senior teachers.

Similarly, countries can adjust their relative spending on retirement benefits and salaries. Higher salaries can make the profession more attractive to starting (and potential) teachers, while higher retirement benefits make the profession more attractive to late-career teachers. Another important factor to take into account in restructuring compensation (also for salary growth) is 'loss aversion' (a concept pioneered by Kahneman

(1979)), which refers to the fact that people experience the negative aspects of a loss disproportionately more than the positive aspects of some gains.

Figure 2. Ratio of salary at the top of the scale to the starting salary.



Source: OECD (2022). Education at a Glance. Adapted from Table D3.1. Teachers' statutory salaries, based on the most prevalent qualifications at different points in teachers' careers (2021)

**Evidence.** Discrete choice experiments offer an attractive way to quantify how (potential) teachers trade off different job attributes. With respect to the trade-off between starting salary and salary growth, Johnston (2021) estimates that a shift from the *status quo* for teachers in Texas (USD 50,000 starting salary, with 1.8% yearly growth in salary) to a higher starting salary of USD 67,000 and 1.3% annual growth would increase the well-being of his sample of teachers, taking into account the positive effect of teachers' experience on student achievement. While the preferences of Texan teachers might differ significantly from those of various EU teachers, these results highlight the importance of the structure of compensation and the potential of discrete choice experiments in helping to optimise it. This result of an increase in starting salary coupled with a decrease in the rate of salary growth (and thus a flattening of the salary scale) mirrors the results of a decentralisation reform of salary-setting in Sweden, which gave schools the autonomy to structure teachers' compensation, rather than imposing a uniform pay structure across the education system. Willén (2021) found that this reform led schools to flatten teachers' salary scales in comparison to the uniform pay structure pre-reform. If schools are better informed about their teachers' preferences, this finding suggests that a flat salary scale might better maximise the attractiveness of the teaching profession. A flat salary scale is in use in Spain, with a high initial salary and more moderate increases as a teacher progresses in their career. In the state of New York, Lankford & Wyckoff (1997) found evidence that teachers' salaries were too back-loaded, possibly due to the political power wielded by senior teachers, and that front-loading teachers' salaries more could increase the retention of early-career teachers.

With respect to the trade-off between salary and retirement benefits, Burge et al. (2021) found that on average, teachers in England value a 1% increase in final pension equivalently to a 0.5% increase in salary, but that early career teachers are close to

indifferent about pension increases. **Shifting increasing compensation efforts from retirement benefits to starting salary would thus be effective in making the profession attractive to early career teachers, as well as to young potential teachers.** The authors also found, in line with prospect theory<sup>9</sup> of Kahneman (1979), that aversion to the worsening of any type of remuneration (and workload) is much larger than any preference towards improvements. Policymakers should thus be careful when introducing policy changes that may have negative side effects.

**In summary, there is no 'silver bullet' with respect to the restructuring of compensation, although there is evidence to suggest that a flatter pay scale might be preferable. In general, countries should carefully assess the preferences of their own (potential) teachers with regard to different forms of compensation, and take these preferences into account when restructuring compensation.**

### 2.1.3. Performance-based pay

**Rationale.** Performance-based pay can help to mitigate teacher shortages by potentially making the profession more attractive, particularly to those who may be considering a second career or who are transitioning from another sector. It can also potentially increase educational quality. By tying a portion of a teacher's salary to their performance, performance-based pay can attract and retain high-quality teachers who are motivated to excel at their jobs.<sup>10</sup> Moreover, performance-based pay can incentivise teachers to engage in professional development and improve their teaching skills, resulting in an improvement in the overall quality of the teaching workforce. Performance-based pay can also provide recognition and rewards for teachers who are effective in improving student outcomes. This can help to motivate teachers to continue performing at a high level, which can help in addressing teacher shortages by reducing turnover and retaining effective teachers. However, measuring teachers' effectiveness is a complex task (Chamberlin, 2002), and evaluating them solely on the basis of quantitative measures (such as test scores, or the value added to student achievement) may not capture the full range of attributes that make up teachers' performance<sup>11</sup> (for example, participation in Erasmus+ projects, mentoring, doing research, participating in extra training or conferences, etc.). Lastly, performance-based pay can provide a more flexible compensation system that allows differentiation based on an individual teacher's performance. This can help to attract and retain teachers who may be coming from other sectors, and are used to a more performance-based compensation system.

**Evidence.** A meta-analysis by Pham et al. (2021) investigates the mechanism connecting merit pay, teacher turnover and student achievement. While recognising the scarcity and somewhat mixed nature of the evidence, they conclude that the existing literature suggests

---

<sup>9</sup> Prospect theory is a behavioural economic theory that explains how individuals make decisions in situations of uncertainty, suggesting that individuals evaluate options in terms of potential gains and losses from a reference point, rather than in absolute terms (Kahneman, 1979).

<sup>10</sup> While this approach may improve teacher motivation and performance, it also raises concerns about the reliability and validity of performance measures.

<sup>11</sup> The majority of the literature focuses on how rewarding an output measure of performance (e.g. students' test scores) affects teachers' productivity and turnover. There is very little evidence regarding the effects of rewarding a measure of teachers' inputs, e.g. teacher credentials (Clotfelter et al., 2007; Goldhaber and Anthony, 2007); monitoring of attendance (Duflo et al., 2012); or teachers' expertise (Berlinski, S., & Ramos, A. (2020).

performance-pay has the potential to increase recruitment and reduce overall teacher turnover, especially in disadvantaged schools.

Personnel economics theories suggest that **offering performance-based pay can enhance the quality of the teaching staff by attracting and retaining high-performing teachers** (Ballou & Podgursky, 1998; Lazear & Shaw, 2007). By means of a difference-in-differences design, evidence from the USA shows that school districts which implemented performance-based pay policies recruited new teachers who graduated from universities and colleges with higher average SAT scores, compared with the teachers hired by districts without such policies. The difference in SAT scores between the two groups was around 30 points (Jones & Hartney, 2017). Furthermore, Johnston (2021) finds that higher-quality teachers (as measured by learning gains on standardised tests) have a stronger preference for performance-based pay. On the one hand, this suggests that increasing the role of performance-based pay in teachers' remuneration might not only increase their motivation, but might also help to attract better teachers to the profession. On the other hand, teachers at schools in disadvantaged areas may be unfairly penalised for factors beyond their control, such as a lack of resources. Furthermore, using difference-in-differences analysis, a study carried out in two school districts in North Carolina, USA, found that the introduction of a sign of teacher quality (namely the adoption of value-added (VA) measures of teacher effectiveness) increased the probability that high-VA teachers would move to high-performing schools. Similar teacher mobility away from schools with higher shares of Black students was also found, raising concerns for educational equity as an unintended consequence of adopting VA measures (Bates, 2020).

Conversely, **performance-based pay has been found to have an effect on retention, although not all of the available evidence is unanimous**. Glazerman and Seifullah (2012) show that the TAP programme<sup>12</sup> in Chicago had a significant, positive effect on teacher retention during its initial two years of implementation, although this effect was not observed during the third year. Compared with matched comparison schools, TAP schools showed higher retention rates in the range of 0 to 20 percentage points, depending on the year and the cohort being evaluated. Using regression discontinuity design, a study by Springer et al. (2016) found that a USD 5,000 retention bonus offered to highly effective teachers in return for working in low-performing schools had no significant effect on teacher retention overall. However, teachers of subjects that were tested who received the bonus were 20% more likely to stay in their low-performing school than teachers who did not receive a bonus. Using a cluster randomised control trial, Fryer (2013) found that a school-wide performance bonus scheme (in which bonuses were given to teachers on the basis of their school's progress report) had no effect on teacher retention. The author suggested that this zero effect could probably be ascribed to the incentives not being large enough, the high complexity of the incentive scheme, and the lower effectiveness of group-based incentives.

**In summary, given the available evidence, it remains unclear whether the positive effects of performance-based pay observed in studies persist over time.**

---

<sup>12</sup> The TAP programme introduced performance-based pay in the form of extra pay (and a promotion to mentor teacher, or other forms of increased responsibility in the school) as well as eligibility for annual performance bonuses, based on a combination of teachers' contribution ("value added") to student achievement and observed performance in the classroom.

**It is also unclear whether teachers would be willing to remain after the incentives end, as some studies have found that these effects are only significant during the initial years of programmes** (Glazerman & Seifullah, 2012; Springer, Lewis et al., 2009), while others have found positive effects only after several years of implementation (Choi, 2015).

#### **2.1.4. Targeted financial incentives**

**Rationale.** Targeted financial incentives (e.g. bonuses or higher salaries offered to teachers who meet specific criteria, such as working in areas of high need or those teaching certain subjects) can be used to mitigate teacher shortages. This option involves offering teachers differential pay to teach in – and remain in – schools that find it difficult overall to attract teachers (e.g. due to the socio-economic composition of the school, or because the area is expensive to live in). Such incentives may also be applied to particular subject areas such as maths, foreign languages or science. By offering higher salaries or bonuses for teachers who teach these subjects or in these areas, schools can attract more teachers to these areas and help to address teacher shortages. Moreover, by financial incentives such as these to teachers who stay at their current school, schools can help to retain effective teachers and reduce turnover rates. These targeted financial incentives have the potential to be more effective than across-the-board salary increases, as they are cheaper to implement and are focused on those areas in which teacher shortages are most severe.

One example comes from the Netherlands, where a "labour market allowance" is available to teachers who work at disadvantaged schools or in schools with pupils who require extra support due to special needs or language skills (Ministerie van Onderwijs, Cultuur en Wetenschap, 2021, 2022).

**Evidence.** While several countries have tried different approaches in recent years, **research into the effectiveness of these monetary incentive programmes for recruitment and retention remains limited** (Loeb & Myung, 2020). Furthermore, while financial incentives have proved effective in attracting new teachers to the profession, evidence regarding the effectiveness of financial incentives in fostering retention is mixed (See et al., 2020a).

One such type of targeted financial incentives is directed towards teachers working in schools that serve disadvantaged or low-performing students. Because teacher shortages hurt students' learning, and are more severe in these schools (Gambi & De Witte, 2023), these incentives have the potential to reduce educational inequality, especially if they help to attract and retain higher-quality teachers. Indeed, using a difference-in-difference-in-differences analysis<sup>13</sup>, Clotfelter et al. (2008) found **that a bonus of up to USD 1,800 per year was sufficient to reduce turnover rates among the targeted teachers by**

---

<sup>13</sup> Difference-in-difference-in-differences (DDD) adds a control group to the classical difference-in-differences design to account for unobservable group- and time-characteristic interactions that cannot be otherwise captured. In practice, DDD augments the classical difference-in-differences design with a third difference for the new control group. In their study, Clotfelter et al. (2008) compare hazard rates (1) before and after the bonus; (2) across eligible and ineligible teachers working in the same school; and (3) between teachers in eligible schools and in those schools that barely missed the eligibility criteria.

**roughly 17%.** The annual bonus was targeted to certified teachers of maths, science and special education in schools with a medium or high level of disadvantage, creating within-school variation in teacher salaries (this feature was exploited to permit causal inference). Furthermore, the study shows that the annual bonus had the highest relative effect on experienced teachers. According to Clotfelter et al. (2008), having teaching experience is a reliable indicator of better academic outcomes for students. **the study's findings further suggest that salary differentials can also be an effective strategy for improving the quality of education in disadvantaged schools, on top of improving teacher retention. Yet, to reduce turnover in the longer term, such programmes would need to offer differentially high salaries for extended periods, not just one-year bonuses.** In addition, the pay differential might need to be quite large to offset the challenges teachers experience in schools that are highly segregated by race or economic status (Clotfelter et al., 2011). In a similar fashion, by means of a difference-in-differences design, a study investigating the effect of a benefit programme (a wage increase of roughly 5%) in disadvantaged schools in the city of Oslo found a positive effect on the probability of hiring teachers with a Master's degree (Gjefsen, 2020). Lastly, Elacqua et al. (2022) studied the effects of the Chilean Pedagogical Excellence Assignment (AEP) programme, under which teachers qualify for a financial bonus if they meet certain quality requirements, with the bonus being higher if the teacher teaches at a disadvantaged school. The AEP financial incentive has proved effective in disadvantaged schools, as AEP teachers are 6 percentage points more likely to remain employed at these schools (Elacqua et al., 2022). While potentially expensive, such incentives can help to reduce educational inequality at a much lower cost than across-the-board salary increases. The results from subsection 2.1.1. on class sizes also suggest that these incentives would be more cost-effective than reducing class sizes in disadvantaged schools.

A second type of targeted financial incentive is aimed at teachers of "hard-to-staff" subjects. Such financial incentives can be particularly effective, as they target teachers who would otherwise be able to earn a higher salary outside of education, which is an important reason for the higher teacher shortages in STEM subjects (Loeb & Page, 2000). Using a difference-in-differences design, Feng & Sass (2018) show that **financial incentives can be an effective tool to promote the retention of teachers in areas of high need.** In particular, the study investigates the effects of loan forgiveness and a bonus provided to certified early-career secondary school teachers in "high needs" subjects, if they remained within the same district, eligible subject and grade throughout the following year. The authors found that a first bonus amounting to USD 1,200 resulted in a 32.2% reduction in the likelihood of attrition in the short term, while a 'back-of-an-envelope' cost-benefit analysis suggests that **the bonus programme was cost-effective.** Methodological more robust studies indicate that financial incentives are effective in retaining teachers in hard-to-staff areas, but only when there is some kind of tie-in involved, whereby teachers commit to staying for a specified period (See et al., 2020b). In Norway, a similar approach was taken, whereby a wage premium of approximately 10% was granted to retain teachers in high-vacancy schools, which was lost once teachers moved to a low-vacancy school. The wage premium was found to reduce the likelihood of teachers voluntarily quitting by about 6 percentage points (Falch, 2010, 2011).

A third type of targeted financial incentives comprise those aimed at retaining late-career teachers. Research into the effects of the rule governing teachers' pensions consistently shows a high degree of responsiveness by teachers to pension system incentives, suggesting that such retention incentives have the potential to affect teaching labour supply (Costrell & McGee 2010; Fitzpatrick & Lovenheim 2014). In relation to this, Brown (2013), Koedel and Xiang (2017) and Kim (2023) have investigated policy measures in which pension plans are characterised by so-called pension back-loading – i.e. the later a teacher retires, the more pension they generate, thus creating an incentive for teachers to work for longer. The three studies show that such financial benefits lead teachers to postpone retirement. The results found by these studies vary from a decrease of 4 percentage points in the likelihood of retiring (Brown, 2013) to 10 percentage points (Kim, 2023) for employees in the retirement age category. Similarly, Kim et al. (2021) simulate the effect of targeted late-career salary bonuses and deferred retirement plans on senior teachers teaching in STEM fields. Their simulation shows **that offering deferred retirement plans (targeted at STEM teachers) can yield additional teaching years by senior teachers** for about USD 30,000 per year, net of salary. **Retention bonuses are somewhat costlier to implement**, at around USD 47,000 per additional year. While the cost of such a programme – between USD 30,000 and USD 50,000 per additional year – is not small, these programmes would be cost-effective if targeted carefully at those teachers who are most effective in terms of impacts on student achievement (Kim et al., 2021). Similarly, **in some EU regions (e.g. Flanders) and in the USA, among other countries, legislation has been enacted to provide incentives for retired teachers to return to the profession.** In Flanders, retired teachers can now earn an unlimited amount of extra income without seeing a reduction in their pension payments if they come back into education. Among other US states, in both Colorado and Michigan, retired teachers are allowed to return to the classroom in (rural) schools that are experiencing teacher shortages without any reduction in retirement benefits (Lachlan et al., 2020). **While attracting retired teachers back into the profession is not a long-term solution to chronic teacher shortages<sup>14</sup>, it does have the potential to immediately fill some gaps in the short term.**

Lastly, mixed results have been found with regard to financial incentives granted to highly qualified career-switchers coming into the education sector. While financial incentives succeeding in attracting new teachers, Fowler (2003) found that among recipients of a USD 20,000 bonus to switch careers to teaching, dropout rates were higher than the national US average (46% by the third year), and were highest in the districts with high needs (55%). **These findings are in line with the literature on the evaluation of 'signing bonus' incentives, which suggests that any effect tends to be short-term** (See et al., 2020). Another means of attracting people into teaching as a second career is to offer a competitive wage that accounts for the years of wage seniority they bring with them. In an attempt to attract individuals into teaching from other professions, a policy proposal has been made in Flanders to adequately compensate the seniority of teachers coming

---

<sup>14</sup> In particular, because teacher pay in most education system increases with experience, retired teachers (and those who are close to retirement) are more expensive on average than early-career teachers (Fitzpatrick & Lovenheim 2014). To cut operating costs and generate budget savings, school districts in the US that are facing financial difficulties have used incentives to encourage teachers to retire (Fitzpatrick & Lovenheim 2014; Hosek et al., 2023). Therefore, policymakers under tight budget constraints must also take this consideration into account.

from other sectors. Specifically, it is proposed that those switching career to education could take up to 20 years of seniority from other sectors.

**In summary, given the available evidence, we conclude that targeted financial incentives a cost-effective method to mitigate teacher shortages.**

## 2.2. Workload

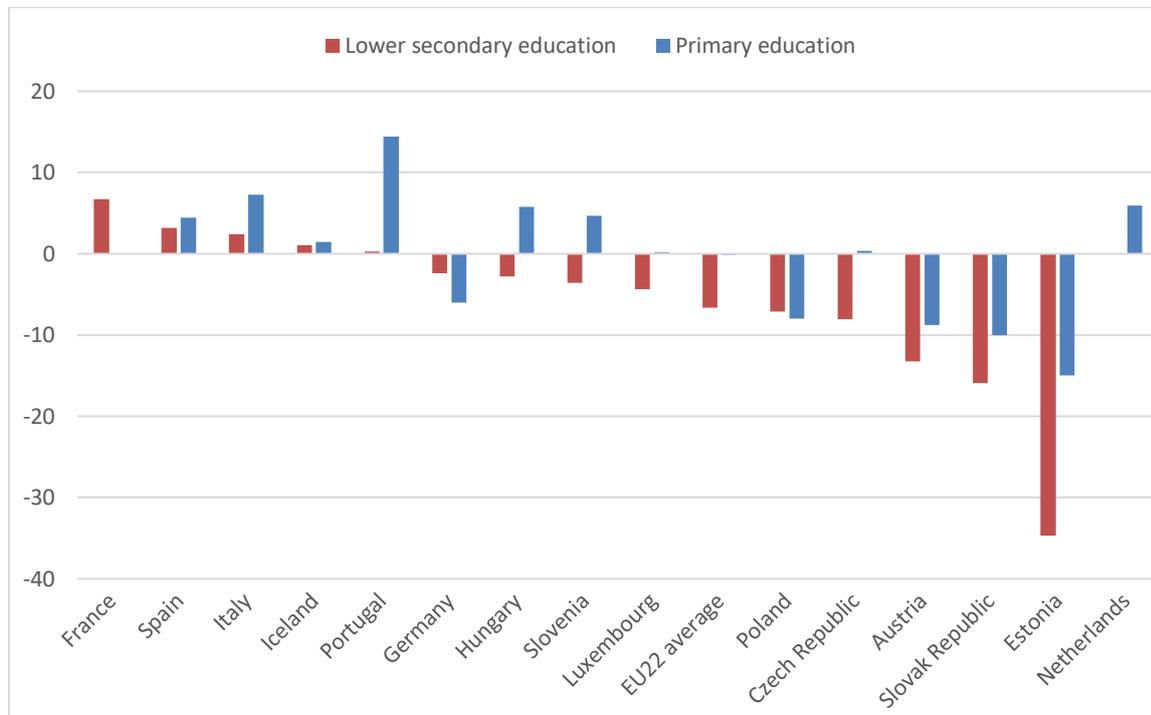
Workload is cited as one of the most important reasons why teachers leave the profession, or why potential teachers consider the profession to be challenging (Burge et al., 2021; Carlo et al., 2013; Carrizosa & De Witte, 2023; Kyriacou et al., 2003; Manthei et al., 1996; OECD, 2005; Saks & Soosaar, 2016). This section discusses three possible ways to reduce teachers' workload, considering evidence on their cost-effectiveness.

### 2.2.1. Changing class sizes

**Rationale.** The first – and frequently discussed – way of reducing teachers' workload is reducing class sizes. According to OECD data, the average size of primary school classes in the 22 EU countries that are members of the OECD is 19 pupils, ranging from 17 in Greece to 22 in Spain, France and Hungary. Teachers often state a strong preference for reducing class sizes. For example, in Carlo et al. (2013), students in tertiary education, teachers in initial teacher education, and working teachers from an EU-wide sample state 'fewer students per class' as the third most effective policy measure to increase the attractiveness of the teaching profession. In that same study, teachers rate 'too many students per classroom' as the third most challenging aspect of the teaching profession. These results suggest that reducing class sizes is an effective way of increasing the attractiveness of the teaching profession. **Reducing class sizes has the added potential advantage of raising learning outcomes, although many studies (especially policy evaluations) also find null results on this** (Leuven & Oosterbeek, 2018). In addition, teachers in OECD countries rate reducing class sizes as the highest spending priority (OECD, 2019a). It is therefore unsurprising that many countries have reduced class sizes in recent decades, as shown in Figure 3. In lower-secondary education, average class sizes in the 22 EU countries that are members of the OECD (the EU-22) decreased by 7% between 2005 and 2014. Many countries have reduced class sizes in schools with more disadvantaged students. Across the OECD countries as a whole, class sizes are almost 15% larger in the bottom quartile with respect to number of disadvantaged students, compared with the top quartile (OECD, 2018).

However, a decrease in class sizes requires a proportional increase in the number of teachers required to keep pupils' learning time constant. **Reducing class sizes is thus not only a very expensive policy measure, but one that might even worsen teacher shortages.** This may be one reason why countries with smaller class sizes usually pay lower teacher salaries, controlling for spending per student (OECD, 2005). **Reducing class sizes would only be cost-effective in tackling teacher shortages if the attractiveness of the teaching profession increases disproportionately more than the necessary increase in the number of teachers.** A 5% reduction in class sizes entails the need to hire 5% more teachers, and thus an increase in spending on teachers' salaries of about 5%.

Figure 3. Changes in average class size during the period 2005-2014, expressed in %



Source: adapted from OECD, 2016

**Evidence.** Johnston (2021) measured the preferences of Texan teachers' with regard to class sizes using a discrete choice experiment, and found that teachers did not value lower class sizes enough to warrant the associated cost. The teachers studied valued a 34% reduction in class sizes equivalently to a 12% increase in salary. Fuchsman et al. (2023) report even stronger results for a nationally representative sample of US teachers. In this study, teachers valued a reduction in class size of one pupil (5% of the average US class size) equivalently to a 0.5% increase in salary, a difference of around a factor 10. **An across-the-board salary increase would thus be much more cost-effective at raising the attractiveness of the teaching profession than a reduction in class size.**<sup>15</sup> While the preferences of US teachers might differ significantly from those of their EU counterparts, it seems unlikely that EU teachers would show much greater preferences for smaller class sizes – especially given that class sizes in the US are similar as those in the EU, and the US faces similar pressure from teachers and teacher labour unions to reduce class sizes (Weingarten, 2019).<sup>16</sup> These results even suggest that increased class sizes, accompanied by a proportional increase in salary, would be a budget-neutral way of improving the attractiveness of the teaching profession. Because class sizes can have a positive effect on learning outcomes (Leuven & Oosterbeek, 2018), the desirability of this policy measure, both in general and with respect to disadvantaged schools in particular, depends on whether the increased salary would also attract better teachers, and how good

<sup>15</sup>In addition, Johnston (2021) finds that those teachers who are more strongly considering leaving their job are 7.3% less averse to large class sizes, making a reduction in class sizes an even less effective means of tackling teacher shortages.

<sup>16</sup> Class sizes for the sample of Texan teachers were even larger, at 28.7.

school principals are at distinguishing teacher quality. If such conditions are met, increased class sizes compensated for by increased salaries might enhance not only teachers' welfare, but also educational quality. Teacher quality is a far more important determinant of learning gains than class size. For example, the additional learning gains derived from a reduction in class sizes by 10 pupils (approximately halving classes) is roughly equivalent to the additional learning gains from having a teacher in the 85th percentile of teacher quality, rather than an average teacher (Hanushek & Rivkin, 2006). In relation to this topic, Dieterle (2015) found that the additional teachers necessary to compensate for lower class sizes in California were generally of lower quality, as measured by their pupils' learning gains on standardised tests.

In summary, the available evidence suggests that **increased class sizes, compensated for by a proportional increase in teacher salaries, would be a budget-neutral way of enhancing teachers' welfare. This suggests that targeted financial incentives for teachers in disadvantaged schools would be more effective in tackling teacher shortages than the current policy in many countries of reducing class sizes.** The effect of such a reform on educational quality is unclear. While smaller class sizes are associated with some learning gains, such gains could alternatively be brought about by larger class sizes in combination with an increase in the average quality of in-service teachers.

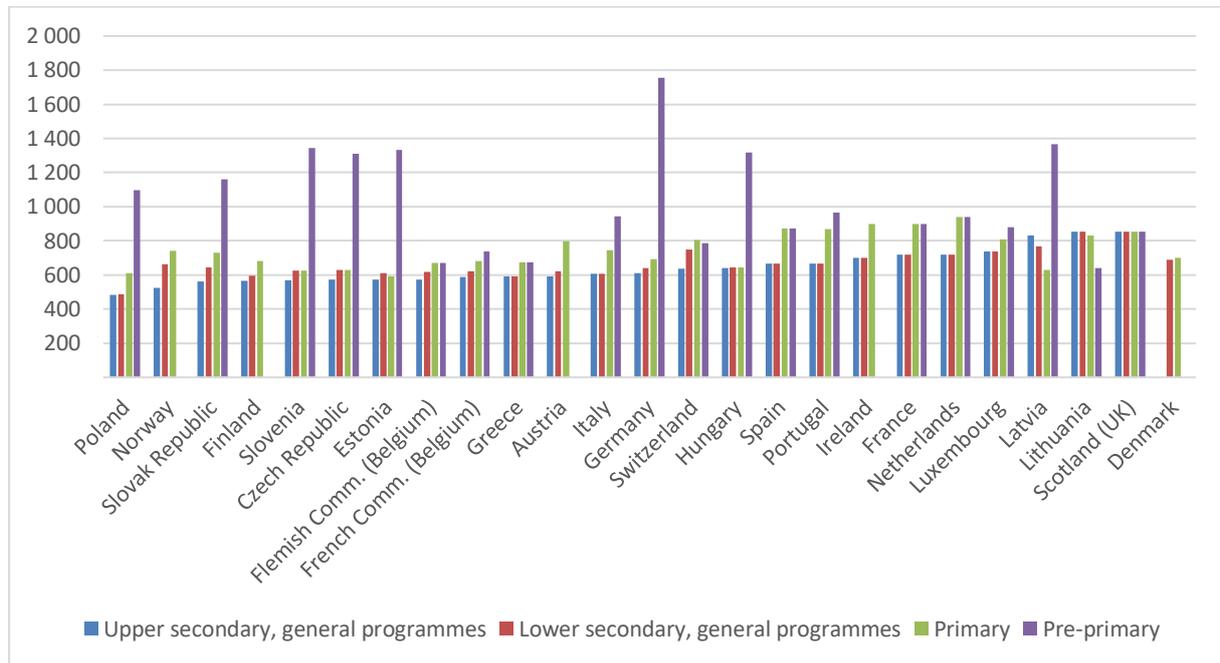
### 2.2.2. Reducing the number of statutory teaching hours

**Rationale.** A second way to reduce teachers' workload would be to **reduce the number of statutory teaching hours** per teacher (defined as the number of hours that a full-time teacher is expected to teach a class of pupils, excluding overtime and preparation time).<sup>17</sup> In many European countries (e.g. Germany, Estonia, Hungary, Ireland and the Netherlands), teachers are burdened with a heavy workload, frequently working extended hours under demanding circumstances, which can result in burnout and attrition from the teaching profession (Ecorys, 2023). As shown in Figure 4, the average number of statutory teaching hours for EU countries is around 640 hours per year in upper-secondary education, albeit with wide variation, ranging from fewer than 500 hours per year in Polish upper-secondary education, to around 850 hours per year in Lithuanian upper-secondary education (OECD, 2022b). As with reducing class sizes, in order to reduce teachers' statutory teaching hours while keeping pupils' learning time constant, countries would need to hire additional teachers. Such a policy measure would only be cost-effective if the attractiveness of the teaching profession increased disproportionately more than the necessary increase in the number of teachers. Moreover, simply reducing the number of statutory teaching hours would not fully address the pressure points for teachers. To do this, policy measures would have to address not only the workload in terms of hours, but also its intensity (so-called 'heavy hours') (Thompson et al., 2023).

---

<sup>17</sup> Other administrative tasks that relate to teaching are discussed in subsection 2.2.3.

Figure 4. Total statutory teaching hours of teachers per year, by level of education (2021)



Source: adapted from OECD (2022). Figure D4.1. Net statutory teaching time in hours per year, in public institutions.

**Evidence. While no policy evaluations have been carried out on the cost-effectiveness of reducing statutory teaching hours in tackling teacher shortages, some evidence does exist on teachers' evaluation of a reduction in total workload.**

Burge et al. (2021) found that teachers in England do not value a decrease in workload disproportionately more than a salary increase. A 1% decrease in workload is valued equivalently to a 0.77% increase in salary. Note that the teachers studied by Burge et al. (2021) valued a 1% increase in workload equivalently to a decrease in pay of 2.71%, suggesting that due to a preference for the status quo, an increase in workload accompanied by a proportional increase in salary would reduce the attractiveness of the teaching profession. Sandmeier et al. (2022) observed that prolonging working hours in education results in more work overload and exhaustion. This is important, as in the past, countries have increased statutory teaching hours as a short-term measure to address teacher shortages (OECD, 2005). These results suggest that this policy measure reduces the attractiveness of the teaching profession even when it is compensated for by a proportional increase in teachers' salaries.

In summary, these results suggest that, again, **a salary increase is more cost-effective at increasing the attractiveness of the teaching profession than a reduction in statutory teaching hours.** This reasoning holds without taking into account the fixed costs of training and hiring new teachers. Increasing statutory teaching hours, even when compensated for by a proportional salary increase, might help to address teacher shortages in the short term, but would reduce the overall attractiveness of the profession.

### 2.2.3. Increasing the role of teaching assistants

**Rationale.** Reducing teachers' workload by **increasing the role of teaching assistants in education** has many advantages. First, assistants can be drawn from a different pool of potential workers. These assistants might not be qualified to be teachers, but they could carry out some of teachers' tasks at a similar level of quality. Teaching assistants can prepare classrooms (e.g. organising materials and supplies), supervise pupils during non-instructional periods, help to grade homework assignments and tests, help to prepare learning materials, provide tutoring in smaller groups, or supervise computer-assisted learning (CAL) sessions (as described in Section 4.4.). Second, on top of reducing teachers' workload, the tasks that these assistants carry out might also be the tasks that teachers draw the least enjoyment from. This reduction in workload would allow teachers to spend more time on their core business: any task closely related to teaching.

The use of assistants is not new. Multiple EU Member States have invested in teaching assistants to maintain the quality of education and support teachers (e.g. Flanders, Bulgaria, Ireland and Lithuania). The question is whether there is potential for further role differentiation in education systems. Here, one can draw an analogy with healthcare professions. The division of tasks between nurses and physicians is a response to the high cost and limited supply of quality physicians, and the potential for some of their tasks to be carried out by less (or differently) skilled workers. In recent decades, differentiation among nurses has increased strongly, with both more advanced and more rudimentary nursing roles being institutionalised (Daly & Carnwell, 2003).

While the increased use of teaching assistants could be cost-effective in tackling teacher shortages while maintaining (or improving) educational quality, this is subject to certain conditions. First, although the use of teaching assistants alongside teachers during classroom hours might enhance learning outcomes (Farrell et al., 2010), it would not result in a significant reduction in teachers' working hours. In order to manage costs, this form of a collaborative teaching would require larger class sizes (see Section 3.8). If the aim of such a reform is to tackle teacher shortages, the focus should be on using assistants to *replace* those tasks currently carried out by teachers that assistants can do to a similar level of quality, rather than using assistants to provide additional support to students. Second, to perform their roles effectively, teaching assistants need to be adequately trained, have clear and specific responsibilities, and have appropriate qualifications for their assigned tasks. Lastly, teachers and assistants would need to collaborate closely and share information. One advantage of a broad range of tasks being carried out by one professional is that each task provides the professional with information that can help them to carry out other tasks effectively, such as specific areas that a student is struggling with, or elements relating to a student's socio-emotional well-being. Improving collaborative practices between nurses and physicians is a well-known challenge in healthcare settings. Thus, to promote collaboration between assistants and teachers, educational policymakers could learn from best practices in the healthcare sector (see, for example, Tang et al. (2013) for a literature review).

**Evidence.** Discrete choice experiments provide mixed evidence on how teachers evaluate the use of teaching assistants. In his sample of teachers in Texas, Johnston (2021) found

that providing a small amount of teaching assistance (a maximum of 5 hours per week) could be a cost-effective way to enhance teachers' welfare, on the condition that this assistance is paid the minimum wage. Burge et al. (2021) found that their sample of English teachers valued a 1% reduction in workload equivalently to a 0.77% increase in salary. This suggests that a teaching assistant paid at less than 77% of a teacher's salary, who could carry out some tasks in the same amount of time and at the same level of quality as a teacher, would be a more cost-effective policy measure to increase the attractiveness of the teaching profession than a salary increase. However, using a discrete choice experiment, De Cort and De Witte (2023b) found that Flemish students in initial teacher education placed a value of around EUR 83 per month on the reduction in workload brought about by the help of an assistant in administration, supervision and corrections for 4 hours per week, which is too low to justify their cost.

Due to the teacher shortages, lower requirements have been set for teachers in many countries. The potential for using less qualified teaching personnel for small-group tutoring can illuminate this discussion. Indeed, there is a lot of causal evidence regarding **the potential for less qualified teaching personnel to be used for small-group tutoring in order to provide quality education in a cost-effective way** (Kraft & Falken, 2021). For example, Guryan et al. (2023) evaluate the effectiveness of high-intensity two-on-one tutoring sessions in improving the maths test scores of US high school students, with tutors mostly consisting of recent college graduates who had been given a short training course of around four full-time weeks. The authors found that these tutoring sessions improved maths learning outcomes by the equivalent of an additional year of learning – a surprisingly high result. Given the lower cost of these tutors, the authors estimate the cost-effectiveness of this programme to be similar to the most successful early-childhood educational programmes –impressive, given the evidence that earlier interventions are more effective (Heckman & Krueger, 2005). Similar results are also found in higher education: Feld et al. (2020) found that in tutorial sessions, Master's and PhD students provide equal learning gains to those produced by professors and teaching fellows. Thus, small-scale tutoring is highly effective, and using less qualified teaching personnel can make it affordable while maintaining much of its effectiveness, as it requires fewer skills than teaching a full classroom. Kraft & Falken (2021) outline a policy blueprint on how to scale tutoring across US public schools by relying on lower-qualified tutors such as university students who are provided adequate training, coupled with high-quality instructional material and ongoing coaching. A small-scale project along these lines, called Power2progress, is already taking place in Ireland. This uses student teachers as tutors in mostly disadvantaged schools.

**In summary, increasing the role of teaching assistants is a promising policy measure to tackle teacher shortages, as they reduce the workload of teachers. However, as yet, insufficient research has been carried out to assess the cost-effectiveness of such a measure in tackling teacher shortages. Evidence also suggests that less qualified teaching personnel are effective within small-group tutoring.**

### 2.3. Job security and time-to-tenure

**Rationale.** Job security is often rated as an attractive feature of the teaching profession, which is why the profession is particularly popular during economically uncertain times (Fray & Gore, 2018; OECD, 2019b; Struyven et al., 2013; Thomson et al., 2012). Such job security is not only due to the teacher shortages, but also due to the difficulty of dismissing tenured teachers in many countries. This can be justified as a means to protect teachers from arbitrary or capricious dismissal (Loeb et al., 2015).

However, while these protections make it more difficult to fire teachers in general, they also make it more difficult to dismiss bad teachers. Addressing this situation would have both advantages and disadvantages. On the one hand, less job security would make teaching less attractive and might harm the profession's prestige. On the other hand, autonomy over firing decisions could be crucial in mitigating teacher shortages, because it enables school districts and administrators to remove underperforming or ineffective teachers from their positions. When schools are unable to dismiss poor-performing teachers, it can lead to a demoralised workforce, decreased teacher retention rates, and a reduction in the quality of education for students. Facilitating the dismissal of tenured teachers would enable school leaders to address performance issues in a timely and effective manner. This would allow school leaders to create a positive working environment in which effective teachers are recognised and rewarded, and underperforming teachers are held accountable. Ultimately, this could help to mitigate teacher shortages by creating a supportive environment that attracts and retains effective educators, thus improving the quality of education for all students.

Tenured teachers may have statutory priority over early-career-teachers in choosing a school. Given the strong nature of tenure, principals might be hesitant to assign tenure too quickly, leading untenured teachers to remain on fixed-term contracts (often of less than a year) for longer (OECD, 2019b). This arrangement is thus beneficial to late-career teachers, but detrimental to early-career teachers, among whom attrition is most acute.

In summary, there are disadvantages and advantages to high job security for teachers. High job security is in itself attractive to potential teachers, but this may come at the cost of a longer time-to-tenure for early-career teachers, and less frequent dismissal of bad teachers, which might hurt the profession's status and create a less enthusiastic working environment.

One example of a policy measure to enhance teachers' job security originates from Flanders where a "teachers' platform" project began in 2018. With a budget of EUR 7.5 million, it provides job security for teachers by allowing them to replace absent teachers and take on different assignments such as co-teaching, supervision or support.

**Evidence.** Little research exists on the relationship between weakening tenure rules and shortages in (quality) teachers. One exception is Loeb et al. (2015), who found that a policy reform in the state of New York which required greater care in decisions to grant tenure, resulted in a longer probationary period for those teachers with low value-added on standardised tests, leading them to be more likely to drop out of the teaching profession. The reform thus improved teacher quality, the most important determinant of

educational quality, but did not help to tackle teacher shortages (and may, in fact, have worsened them). However, the paper does not examine positive effects in the long run, such as an improvement in the profession's status or increased retention rates due to addressing the demoralising effect of the presence of unmotivated teachers.

**In summary, job security is an attractive feature of the teaching profession – but the strong nature of teacher tenure might have adverse effects on the job security of early-career teachers, among whom attrition is highest. There is insufficient evidence to conclude whether changing teachers' job security could help tackle teacher shortages.**

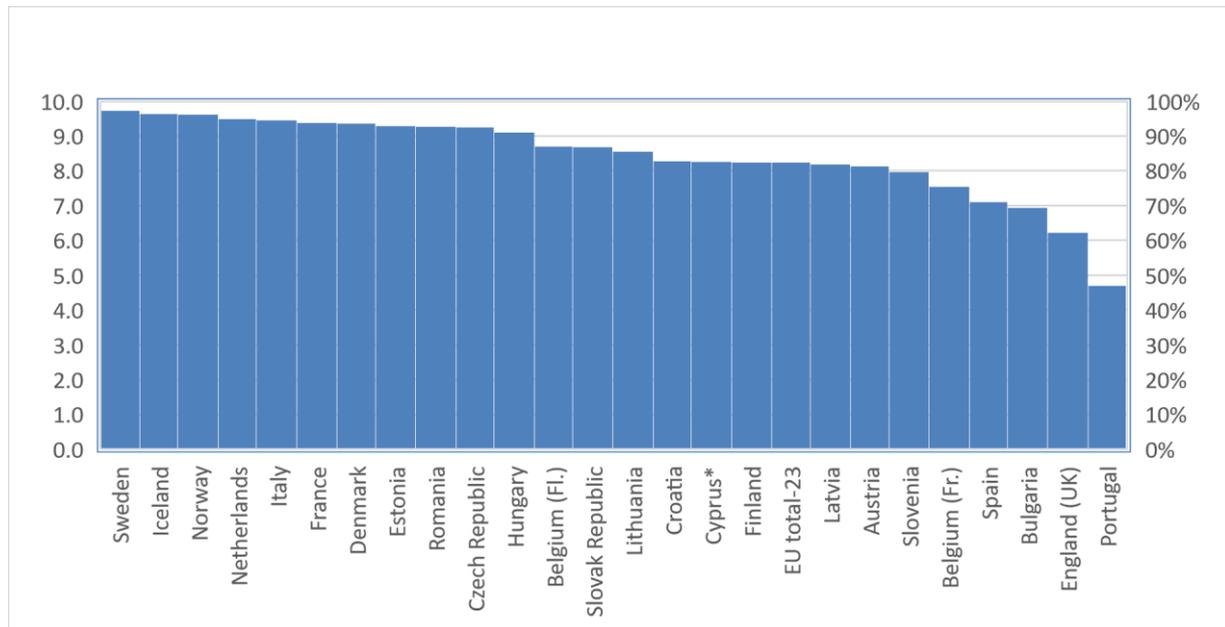
#### **2.4. Teacher autonomy and the teacher as a professional**

**Rationale.** Teacher autonomy refers to the degree of freedom and discretion that teachers have in making professional decisions in relation to their teaching practice, curriculum, and instructional methods (Worth & Van den Brande, 2020). It encompasses teachers' ability to make independent judgements and choices about what and how they teach, as well as affecting their assessment and evaluation practices. Increasing teacher autonomy might help to tackle teacher shortages in a number of different ways. First, autonomy helps to mitigate the negative effect of high workload on teacher exhaustion (Sandmeier et al., 2022; Worth & Van den Brande, 2020). Second, increasing teachers' autonomy might enhance their social status (Dolton et al., 2018; Hoyle, 2001; OECD, 2020). More broadly, teacher autonomy is considered an essential element of teaching, as it is closely linked to job satisfaction and motivation (Kengataran, 2020; Worth & Van den Brande, 2020). These findings are unsurprising, given the prime role of autonomy as a driver of human behaviour and well-being according to self-determination theory (Deci & Ryan, 2000).

Teacher autonomy can, however, come into conflict with education policies aimed at promoting some form of standardisation (e.g. curriculum standards, assessment standards, professional development standards, standardised testing with/without accountability, and so on). Such policies aim to improve educational quality but may unintentionally undermine teachers' professionalism and autonomy. When considering policy measure that affect teachers' autonomy, policymakers should consider their consequences both in terms of educational quality and the attractiveness of the teaching profession.

Comparative international data on teachers' perceived autonomy is somewhat limited. The OECD's Teaching and Learning International Survey (TALIS) provides comparative data on teachers' perceptions of their autonomy in five different domains – but rather than measuring the amount of autonomy teachers perceive that they have, the survey measures whether teachers 'agree that they have autonomy'. Figure 5 shows the results of this question regarding perceived curricular autonomy. A large majority of teachers in most countries agree that they have control over determining course content, though it is unclear how much control they perceive having.

Figure 5. Percentage of teachers who 'agree' or 'strongly agree' that they have control over determining course content



Source: OECD, 2018b

**Evidence.** Research into the effectiveness of increasing teachers' autonomy as a means of reducing teacher shortages is limited. Some studies, such as Guarino et al. (2006), find that self-perceived autonomy is related with lower teacher attrition. However, teachers who perceive themselves as having greater autonomy might simply differ from teachers who perceive themselves as having less, and these differences might be unrelated to teachers' actual autonomy. In Carlo et al. (2013), the effectiveness of increasing teachers' autonomy in tackling teacher shortages is ranked low by in-service teachers, students and those in ITE, as well as by students in non-teaching tertiary education. This doesn't mean that increased autonomy cannot be a cost-effective policy measure, as it would be associated with much lower costs than other policy measures such as higher salaries and smaller classes. De Cort & De Witte (2023b) quantified Flemish ITE students' preferences for curricular autonomy using a discrete choice experiment. They found that an increasing by 20 percentage points the amount of class time that teachers spend on learning goals that they can choose themselves is equivalent to a monthly net salary increase of 6% or EUR 127. This finding implies that enhancing teachers' curricular autonomy could be a cost-effective policy approach to address teacher shortages, provided that the educational systems allow for such autonomy, and considering its relatively low costs.

**In summary, little research has been carried out to assess the (cost-) effectiveness of increasing teachers' autonomy in tackling teacher shortages. One study does find a large preference for curricular autonomy relative to its cost. When considering an increase in teacher autonomy, countries should first assess the preferences of their own in-service teachers. The desirability of increasing teachers' autonomy crucially depends on its effect on educational quality (for example, the value of standardised curricula) and how it affects other elements of education systems such as ITE and assessment systems.**

## 2.5. Using promotional campaigns to attract teachers

**Rationale.** In behavioural economics, a behavioural barrier is a concept that refers to the reasons why people make choices that are not in line with their own welfare (Damgaard & Nielsen, 2018). There may be various behavioural barriers explaining why people do not opt for a teaching career.

First, potential teachers might not opt for the teaching profession because of its social status.<sup>18</sup> People, and especially young people, base their choices not only on their own welfare, but also on how their choices influence their social status and self-image (Damgaard & Nielsen, 2018). Teachers in the EU rate improving the prestige of the teaching profession as one of the most effective policy measures to improve the attractiveness of the profession, along with a higher salary (Carlo et al., 2013). In particular, increasing teachers' social status might help to attract people from groups that are traditionally underrepresented in the teaching profession, such as men and those from a minority background (OECD, 2005; Cortes & Pan, 2018). In other words, focusing on groups which are under-represented and individuals who are pursuing a career change could contribute to expanding the candidate pool (European Parliament, 2020). The importance of role models in relation to students' short- and long-term educational performance makes widening representation an important policy aim (Delhommer, 2022; Gershenson et al., 2018). Given the importance of social status, the relatively low social status of teachers as reported in TALIS 2018 by the OECD (2020) is worrying. Only 26% of teachers in OECD countries agree that their profession is valued by society.<sup>19</sup> Wide variations exist between countries, but on average, EU countries do worse than countries in East Asia. In the Czech Republic, the teaching profession is considered a secondary career path, and only 52% of student teachers had initially chosen it as their first preference. Fewer than 5% of teachers feel valued in the French Community of Belgium, the Slovak Republic and Slovenia, while around 30% of teachers feel valued in Norway and Netherlands. Finland stands out, with 58% of teachers feeling valued by society. Iceland, the Netherlands and the Flemish Community of Belgium also saw a significant decreases in perceived status between 2013 and 2018, with a drop of 20 percentage points in the Flemish Community standing out. Negative media coverage of education as a whole and teachers specifically is one possible reason for (the perception of their) diminishing social status (OECD, 2019b; Pérez-Díaz & Rodríguez, 2014).

Second, a lot of evidence exists that people, especially adolescents, pay limited attention to important life choices such as major choices in higher education (Damgaard & Nielsen, 2018). Simply reminding potential teachers that teaching as a career with many advantages (such as its high degree of meaningfulness and job security) could nudge them

---

<sup>18</sup> Because the social status of teachers is multifaceted, there are many different ways to reflect upon it. Hoyle (2001) makes a distinction between the prestige and the esteem of a profession. The prestige of a profession is 'the public perception of the relative position of an occupation in a hierarchy of occupations'. This hierarchy is abstract, yet everyone seems to have a sense of it. It is also relatively consistent across time and cultures. The esteem of a profession refers to 'the regard in which an occupation is held by the general public by virtue of the personal qualities which members are perceived as bringing to their core task.' These qualities include aspects such as dedication and competence. This esteem derives more from personal experience. In this report, we do not distinguish strictly these different forms of social status, as most of the empirical studies under consideration fail to do so. Generally, though, teachers' prestige is relatively low, but their esteem is relatively high, as people consider teachers to be hardworking, intelligent, caring and trustworthy, and intelligent (Dolton et al., 2018).

<sup>19</sup> Interestingly, principals are much more positive about teachers' esteem, with 37% agreeing that teachers are valued by society.

towards becoming a teacher. Furthermore, **people's beliefs about aspects of the teaching profession, such as the starting salary, might be negatively biased.** Correcting these biased beliefs by providing accurate information about aspects of teaching such as starting salaries could also influence career choices.

Third, **the poor quality of school infrastructure also plays a role, as school infrastructure sends a tangible message to students and teachers about the societal importance of education** (De Witte, 2022). Consequently, well-maintained and adequately equipped school facilities can enhance perceptions of the teaching profession, attract and retain quality educators, and contribute to a positive and respected image of teachers in society. From the perspective of students, inadequate infrastructure distracts students and does not allow good conditions for learning (Barret et al., 2019). From the perspective of teachers, schools with good infrastructure are more attractive, as it enables them to feel more effective and secure. Teachers are more likely to remain in post longer when they can work with adequate infrastructure, and larger classrooms also allow easier team-teaching (Lawrence, 2003). The attractiveness of infrastructure also plays a role in the decision-making process when a graduate teacher has to choose between a job inside or outside of education. During budget cuts, infrastructure projects are the first to suffer, which also explains the more erratic pattern of the statistics over time. As a result of this, European countries and regions have systematically underinvested in school infrastructure (De Witte, 2022). Moreover, equity concerns arise when poor school infrastructure exacerbates the situation in educational institutions that serve more disadvantaged populations.

Using promotional campaigns to tackle teacher shortages can be a particularly attractive policy measure due to their low cost and supposed ease of implementation relative to other policy measures (OECD, 2005). Promotional campaigns would be particularly effective if they can increase the status of the teaching profession. It is therefore unsurprising that campaigns to promote the teaching profession have recently been carried out in many education systems. These include including the Netherlands, Ireland, the Czech Republic and Flanders (Ecorys, forthcoming). Such measures are a particularly attractive alternative to salary increases as a means of improving teachers' social status, as they are much less expensive.

Examples of promotional campaigns are observed in multiple EU Member States. In Germany, campaign images depict subjects in which there are teacher shortages, such as mathematics and science, and recruitment days are held in partnership with the public employment service. Flanders has a promotional campaign aimed at triggering prospective students through challenging statements. The Netherlands has created a website aimed at providing information on teaching to beneficiaries of unemployment benefits. France also conducts recruitment days in key geographical areas.

**Evidence.** There is little evidence that promotional campaigns can improve the social status of teachers or address other behavioural barriers. Promotional campaigns are relatively common, but their effectiveness is rarely carefully examined. For example, the Swedish government carried out a promotional campaign specifically aimed at boosting the social prestige of the teaching profession. However, this campaign was introduced together with an increase in salary and improved salary progression for teachers, which are

important determinants of a profession's social status (Hoyle, 2001). Sweden saw an increase in teachers' social status following these reforms, but it is unclear if this increase was a result of the promotional campaign (OECD, 2005). De Cort & De Witte (2023b), however, **provide encouraging evidence of the potential of a good promotional campaign in tackling teacher shortages**. They researched the effect of informing Flemish students in initial teacher education about the general public's high level of trust in teachers, and their high evaluation of the contribution teachers make to society – two important determinants of a profession's status. Using a randomised controlled trial, the researchers analysed the effect of these messages on student teachers' preference to become a teacher, over their preferred alternative career. It was found that the treatment increased students' preferences to become a teacher by the equivalent of a 3.6% increase in teacher salary, and increased their stated likelihood of becoming a teacher by 5 percentage points.

In addressing the behavioural barriers with respect to limited attention and biased beliefs, Ajzenman et al. (2020) provide encouraging evidence of large-scale implementations. They find that interventions which either emphasise altruistic or extrinsic motivation via text messages, pop-ups and an introspective writing exercise, increased Peruvian teachers' preferences for working in disadvantaged schools, as stated in their school allocation system. However, the effect of the treatment on their actual school allocation was barely statistically significant. This was partly due to the increases in ranked preference given by teachers to disadvantaged schools being limited to lower rankings (i.e. such schools usually did not rise to become the teacher's first or second choice). On a smaller scale and in a more general context, Ersiy & Speer (2022) and Wiswall & Zafar (2015) found that (US) students hold biased beliefs about the expected earnings and likelihood of employment stemming from different majors. The studies found that students update their beliefs about these factors after receiving correct information, and that this influences their choice of major. They also found that many students are unsure about which major they want to do, suggesting that there is room to nudge their choices. Coffman et al. (2017) provide a different example of how 'low-touch' nudges can be a cost-effective measure to tackle the teacher shortage. In this study, providing information about how many participants in the 'Teach for America' alternative recruitment path end up becoming teachers (a social comparison nudge) increased the number of participants that became teachers by 1.8 percentage points. These types of studies are the reason why nudging interventions (such as promotional campaigns) are so popular: they can produce small but significant effects relative to their very low costs (Thaler & Sunstein, 2009).

However, Azenjman et al. (2021) provide strong evidence on how **interventions designed with the best intentions can still backfire**. The paper evaluates the effect on the likelihood of high-school students in Chile applying for initial teacher education of three different large-scale email campaigns that emphasised different motivations for becoming a teacher. Each of the campaigns respectively focused on altruistic reasons (e.g. making a difference in students' lives); extrinsic reasons (e.g. earning a high starting salary and having high employability); or reasons of prestige (e.g. being valued by society). Behavioural economic insights (such as the value of testimonies) were used to maximise effectiveness of the information delivery. **The authors found that the campaigns which stressed altruism and prestige as motivations had no effect on the likelihood of low-performing students applying for initial teacher education, and reduced the**

**likelihood of high-performing students applying.** The authors argue that these two treatments might have accidentally made the downsides of working as a teacher more salient, while failing to meaningfully change students' beliefs about the merits they emphasised. More concretely, the testimonies emphasising the prestige of the teaching profession failed to convince students that teaching is a valued profession, and in fact reminded them of their current beliefs about the low prestige of the teaching profession relative to their alternative career options. The campaign emphasising extrinsic reasons to become a teacher did increase applications from low-performing students, but had no effect on applications from high-performing students, who more often come from high-SES households.<sup>20</sup> Combining the treatments emphasising intrinsic, prestige and extrinsic motivation might have prevented this possible backfiring effect. Alternatively, combining more intensive forms of treatment, such as real-life testimonies, with a Q&A that can address any concerns prompted by these testimonies, might be less likely to backfire than an email campaign. The approach used in Sweden, where the promotional campaign was combined with real improvements in teachers' working conditions, might also prevent backfiring.

**In summary,** promotional campaigns can be an attractive policy measure to tackle teacher shortages due to their low costs, but they are not always effective and may even backfire. The Chilean example described by Azenjman et al. (2021) illustrates how behavioural research has failed to find any *golden rules* on how to nudge human behaviour regardless of the specific context of the decision and decision-maker in question (Bryan et al., 2021; Damgaard & Nielsen, 2018; Oreopoulos, 2021). Learning from the successes and failures of previous studies is important, but is not enough to guarantee an effective campaign. **Policymakers should therefore evaluate the effectiveness of their promotional campaigns through randomised controlled trials before rolling them out nationwide.**

## 2.6 Promoting gender diversity in the teaching profession

**Rationale.** In most Western countries, the teaching workforce is predominantly made up of female teachers at both primary and post-primary education levels. This predominance is highest in primary schools, where women constitute the vast majority of teachers across Europe (87%) and in most other upper-middle (72%) and high-income countries (82%) (UNESCO Statistics 2020). In this regard, the literature has used the term the 'feminisation' of the teaching profession to refer to male teachers being outnumbered<sup>21</sup> by female colleagues across most education systems in Western countries (Heinz et al., 2023). Notwithstanding this predominance of women, school leadership positions have largely been filled by men, with the percentage of women principals being significantly below their representation among the teaching workforce (Reynolds, 2012).

The debate on the broadening of gender diversity in the teaching profession is grounded in multiple motives in addition to the framework of social justice (Heinz et al., 2023). On

---

<sup>20</sup> The fact that grades in university don't seem to predict teachers' value-added on students' scores in standardised tests (Kane et al., 2008) suggests that attracting low-performing students need not imply a reduction in teacher quality.

<sup>21</sup> While we recognise that the term 'feminisation' has taken up multiple meanings in the literature (Skelton, 2002), we use it here to refer exclusively to the profession being statistically dominated by women.

the one hand, some authors argue that a teacher of the same gender may have positive effects on students' outcomes, thanks to more effective communication and a higher expectation of performance (in other words, the so-called "Pygmalion effect" – see, for example, Friedrich et al., 2015; Rosenthal & Jacobson, 1968). On the other hand, the literature on the feminisation of the teaching profession is intertwined with the debate on the gender gap among students in certain subjects (Paredes, 2014), with girls outperforming boys in reading (van Hek et al., 2019). In maths, a slight disadvantage among girls is observed in primary education in most European countries, due to the presence of a higher share of low-achievers among girls than among boys. Yet this gap mostly disappears in secondary education (Eurydice, 2022b). According to this stream of research, the teacher's gender can have an effect on the behaviour of students through role-model effects or stereotype threats (see, for example, Dee, 2007; Holmlund & Sund, 2008). From a cost-effectiveness perspective, if role models play a role in student performance and thus enter the function of education production, policymakers should take these considerations into account when drawing up policies aimed at maximising output (Holmlund & Sund, 2008).

Next to education outcomes, a more gender-balanced teacher labour force might also mitigate teacher shortages. First, attracting more men to the teaching profession could potentially alleviate teacher shortages by naturally expanding the pool of potential candidates. Second, we can hypothesise that a more balanced teacher workforce might also lead to improved teacher retention. When teachers feel that their colleagues and the school environment are inclusive and supportive, they are more likely to stay in their jobs. This can help to address the problem of teacher turnover, which is a significant contributor to teacher shortages. Similarly, it is argued that a balanced representation of genders in the teacher workforce creates a more diverse and inclusive environment, which can attract a broader pool of potential candidates (OECD, 2015). Third, gender stereotypes can discourage potential candidates from entering the teaching profession. In other words, a more diverse teacher workforce might also inspire more students to consider teaching as a career path, leading to a more significant supply of qualified candidates in the long run.

**Evidence.** First, the empirical evidence provides no strong support for the hypothesis that teacher–student gender matching improves students' educational outcomes. For example, Cho (2012) investigated the teacher gender effect hypothesis using four waves of TIMSS data across 15 countries. Using fixed-effects models, Cho (2012) found that in eight out of 15 OECD countries, teacher–student gender matching has no effect on students' test scores. Furthermore, the study shows that in the countries (7) where a positive correlation between teacher gender and student achievement is found, this was due to differences in teachers' levels of knowledge about the subject. Similarly, Winters et al. (2013) found no statistically significant relationship between teacher–student gender matching and student achievement in maths or reading at elementary school.

Second, while only a limited number of studies have reported gender differences in attrition patterns, the literature shows conflicting results. For example, Borman & Dowling (2008) found that female teachers were 1.30 times more likely to leave the classroom than male colleagues, while other authors found that among those teachers who had begun teaching, the percentages women and men who were still teaching after 5 years were similar (Raue et al., 2015; Redding & Smith, 2016).

Third, while the evidence on attrition and retention seems inconclusive, lab experiments have found that women are less productive than men under competitive compensation schemes, but women are also less likely to remain in such a scheme if given the opportunity to opt out (Niederle & Vesterlund (2007). In line with these results, Hill & Jones (2020) found that male teachers are slightly more likely than female teachers to remain in schools with a performance-based pay scheme<sup>22</sup>, relative to schools with flat salaries. Despite the potential of performance-based pay schemes to attract and retain male teachers, their potential negative effect on female teachers calls for other solutions to be found (see Section 2.1 for findings relating to salary and targeted financial incentives).

**In summary, while attracting more men to the teaching profession could alleviate teacher shortages by naturally expanding the teaching workforce, more research is needed to investigate the best ways to attract male teachers.**

## 2.7 Attracting underrepresented groups into the teaching profession

**Rationale.** There are limited data from European countries on the diversity of their teaching workforce with regard to factors such as migrant status, minority background, or socio-economic status (Ecorys, 2016). Yet those data that are available show significant under-representation of various minorities and/or socio-economically disadvantaged groups (Ecorys, 2016). Discrepancies are becoming increasingly evident in both Europe and the USA between the level of diversity among the student population and the corresponding level of diversity present among the teaching workforce (for evidence on European countries and USA, respectively, see Ecorys, 2016, and Villegas & Irvine, 2010).

The call for **enhanced participation in teaching by underrepresented groups such as individuals from ethnic minorities, those with lower socio-economic backgrounds, the LGBTQ+ community, and people with disabilities, has been primarily grounded within the framework of social justice (Heinz et al., 2023)**. In particular, the role that teacher diversity can play in working towards a more just and equitable society and education system has been conceptualised through two main elements. First, the **'equity of access'** perspective highlights the need to eliminate the wide range of barriers<sup>23</sup> that individuals from under-represented groups may encounter at different stages of their progression into the teaching profession (Heinz et al., 2023). Second, the **'equity through access'** rationale emphasises the benefits of a diverse teaching workforce for students, schools and society as a whole (Childs et al., 2011). For example, increased diversity in the teaching workforce can influence the behaviour and educational outcomes of students through role-model effects (see, for example, Lewis & Toldson, 2013); stronger connections (Villegas & Irvine, 2010); and the higher

---

<sup>22</sup> A study by Hill & Jones (2020) investigates a setting in which teachers receive a bonus if their students exceed some threshold level of achievement.

<sup>23</sup> In Europe, a report by Ecorys (2016) identified a list of the main barriers to diversity in the teaching profession, among which were: risk of discrimination at different stages of the pathway (in access to initial teacher education, in recruitment practices, and in the workplace), and a higher risk of burnout due to a monocultural approach to teacher education (for a complete list, see Ecorys, 2016). For example, while a headscarf ban was officially lifted in various countries (e.g. in Austria and Germany), in other European countries this is still at the discretion of the employer (e.g. in Belgium, where school districts have the power to decide on this matter).

expectations of teachers for students from those backgrounds (e.g. Tenenbaum & Ruck, 2007; Ouazad, 2014).

Next to education outcomes and social justice considerations, diversification of the teaching workforce could also mitigate teacher shortages. First, attracting more underrepresented groups into the teaching profession can potentially alleviate teacher shortages by naturally expanding the pool of potential candidates. Second, we can hypothesise that a more diverse teaching workforce could also lead to greater teacher retention. In particular, moved by a “humanistic commitment” to making a difference in the lives of students from similar backgrounds, minority teachers are more likely to seek employment in schools that serve predominantly minority student populations (often in low-income, urban areas), and are more likely to stay longer in these schools (Quiocho & Rios, 2000). In other words, individuals from underrepresented groups, such as racial and ethnic minorities or individuals from low socio-economic backgrounds, often have a greater propensity to serve and remain in communities with similar demographics. Consequently, schools could potentially reduce teacher attrition rates and increase retention rates in (the hard to staff) schools serving these communities.

**Evidence.** First, **the literature shows support for the hypothesis that teacher–student ethnicity matches improve students’ behaviour and educational outcomes.** For example, using fixed-effects models with a rich panel dataset, Gottfried et al. (2022) found that student–teacher race and ethnicity matches were associated with fewer unexcused absences (but not excused absences) for Latinx students, with the strongest associations being observed for students in 11th and 12th grades – the age group (usually 16 to 18) that has the greatest individual agency when it comes to school absences. In line with these findings, Wright et al. (2017) suggest that students of colour have fewer reported behavioural problems when paired with teachers of the same-ethnic background. Furthermore, by means of a randomised experiment, Dee (2004) found that teachers with the same-ethnic background increase students’ academic performance, attendance and college-going rates. Empirical evidence has also shown that same-ethnic background teachers are less likely to suspend/expel students of the same ethnic background than they are to suspend/expel students of another ethnic background (Lindsay & Hart, 2017).

Despite the positive impact on students of workforce diversification and efforts to increase it in both Europe and the USA, **few empirical studies have investigated the determinants and potential solutions to the recruitment, attrition and retention of minority teachers** (Ingersoll, 2019). In this regard, higher turnover rates have been observed among minority teachers compared with their non-minority colleagues, which the literature suggests is due to poor working conditions in their schools (Ingersoll, 2019) and the cumulative effects of discrimination experienced in schools (e.g. in the UK, Bradbury, 2022, and Haque & Elliot 2017; in the USA, Pizarro & Kohli, 2018). As a way to increase the pool of qualified teachers from a diverse background, Carothers et al. (2019) highlight the importance of attracting more students into teacher preparation programmes. In their study, a collaboration between a university and school districts to offer dual enrolment courses and a summer school programme for high school students who were considering teaching careers, positively influenced students’ perceptions of teaching as a career. The study results suggest that early exposure to teaching experiences positively influences high

school students' attitudes towards employment in the teaching profession. However, the findings of this study are limited since they are correlational in nature, and only a small sample was considered. Lastly, while many countries in Europe have engaged in initiatives targeting teacher diversity (for a review, see Ecorys, 2016), few of these initiatives have been the object of a formal evaluative process. For example, the results of an evaluation of the French Jobs of the Future: Teachers (*Emplois d'Avenir Professeur*, EAP) programme show that, as a result of individual grants to students of migrant/minority origin, more people of migrant/minority background are entering initial teacher education.

**In summary, while attracting a more diverse teaching population into the profession could alleviate teacher shortages by expanding the teacher workforce as well as improving students' behavioural and educational outcomes, further evidence is needed as to what types of initiatives might best attract and retain teachers from a minority background.**

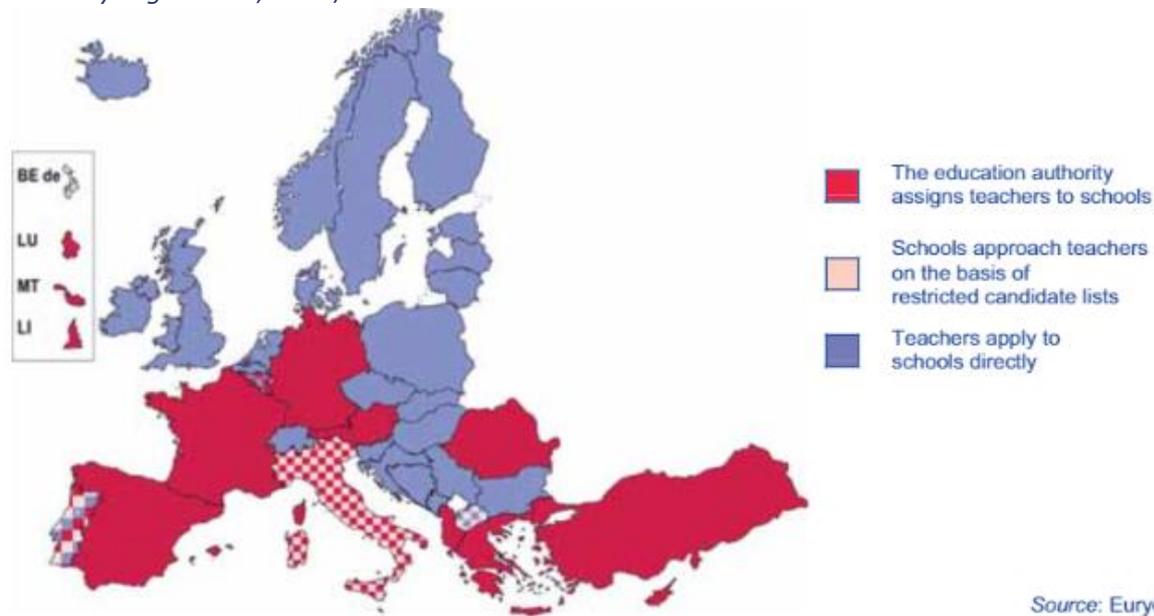
## Chapter 3. School-level interventions

Human resource management is crucial to an organisation's performance (Becker & Gerhart, 1996). This is especially the case for schools, where human capital is the most important input (Hanushek & Rivkin, 2006). Hence, to mitigate teacher shortages, the organisation and leadership in schools play an important role. **Well-governed schools attract and retain quality teachers, who feel valued and supported by the school community.** Teachers who feel connected and supported by their colleagues within learning communities and team-teaching environments are more likely to remain in the profession. Similarly, mobility between teacher levels enables teachers to grow and progress within their profession, leading to improved retention rates. Innovative staffing models such as multi-classroom methods and cross-curricular work can help to maximise resources by creating more efficient use of staffing resources. In addition, strong school leadership plays a critical role in mitigating teacher shortages. Leaders who prioritise and invest in teacher development and create a positive school culture help to foster an environment that supports teacher retention. Schools that invest in these elements of effective practice not only retain more teachers, but also create a more stable and sustainable teaching environment that benefits both teachers and students. **Ultimately, mitigating teacher shortages requires a multifaceted approach that recognises the importance of supporting and valuing teachers as professionals.**

### 3.1 School autonomy over the policies to hire and fire teachers

**Rationale.** Schools play a fundamental role in the recruitment and selection of individuals into teaching. After teacher education, they act as a second gateway to determine which teacher candidates enter the workforce (Dee & Goldhaber, 2017). Wide variation exists between education systems in autonomy given to schools with respect to the decision to recruit or dismiss teachers (see Figure 6). In France and Southern European countries such as Greece, Italy and Spain, hiring decisions are made by an allocation system from the relevant education authority taking into account teachers' preferences, usually after some centralised competitive examination. In Nordic and Eastern European countries, schools make hiring decisions themselves (though which candidates are suitable is to some extent regulated; for example, through candidate lists) (Eurydice, 2018). In theory, a centralised allocation system could help to ensure an equitable allocation of teachers across schools, as they can overrule teachers' preferences to join schools with fewer disadvantaged students (see, for example, Johnston, 2021). Distributing teachers more equitably between schools with respect to the proportion of disadvantaged students in each school could help to tackle teacher shortages, as an inequitable distribution leaves the more challenging schools for beginner teachers, which increase attrition among beginner teachers and leads to greater educational inequality. One downside of central allocation systems is that they make hiring decisions on the basis of a narrower set of teacher characteristics than schools are able to do (OECD, 2018) – possibly leading to a worse teacher-school fit, which is detrimental to teacher retention. Meanwhile, an advantage of decentralised teacher hiring systems is that they can reinforce the advantages of giving schools autonomy over remuneration, discussed in Section 3.3. This is due to their complementary nature (i.e. being able to adapt remuneration to a specific candidate is only possible in a decentralised system).

Figure 6, Teacher hiring decisions in primary and general secondary education according to top-level authority regulations, 2016/2017.



Source: Eurydice (2018). Note on Finland: the legal employer of teachers is the education provider, most commonly a municipality. Education providers advertise specific positions in specific schools. Teachers apply to the education provider for a job position in a specific school.

Another factor to consider is autonomy over firing decisions. **Schools' autonomy over firing decisions is often less than over hiring decisions** (OECD, 2018). While autonomy over hiring decisions can be beneficial, autonomy over firing decisions may have unintended consequences. Jacob (2010; 2011) found that principals with greater autonomy over firing decisions were more likely to fire teachers. The (dis)advantages of lower job security for teachers are discussed in detail in Section 2.4.

**Evidence.** Both centralised and decentralised systems for hiring teachers suffer from challenges in allocating experienced teachers to more disadvantaged schools, even in spite of systems of differential funding for more disadvantaged schools (OECD, 2018; Bertron et al., 2023; OECD, 2022a). On average, though, countries with more decentralised systems for teacher hiring have a more equitable allocation of teachers across schools, both in terms of teacher seniority and in terms of teacher shortages (OECD, 2018). Countries in which schools report a higher degree of autonomy over teacher hiring decisions also have better learning outcomes (OECD, 2018). This result can be questioned in two ways: first, it is only based on correlation, such that other policy differences that correlate with school autonomy over teacher hiring decisions (such as autonomy over wage setting) might explain this result. Second, such results are inherent to the specific design of the centralised allocation systems currently in use. Just because current systems have not succeeded in realising the equitable allocation of teachers, it does not mean that centralised allocation systems are incapable of doing so.

**In summary, neither theory nor the available evidence allow a firm conclusion as to whether centralised or decentralised teacher allocation systems are better at**

**tackling teacher shortages. The same holds true for school autonomy over firing decisions.**

### 3.2 Updating recruitment practices

**Rationale.** Although the available evidence reviewed in Chapter 2 shows that financial compensation can be a driver of both attrition and retention (See et al., 2020b), schools typically do not have much leeway to alter teachers' remuneration as these decisions are mostly made at the state administration level (see Section 3.3). Nevertheless, schools can use their available resources in an effective way by improving their hiring practices. Despite this, schools' hiring practices have not evolved at the same rate as those in other industries, and often focus exclusively on paper screening such as the checking of resumé and transcripts (Kimbrel, 2019), rather than on performance-based or predictive measures (Konoske-Graf, Partelow, & Benner, 2016).

First, **selection criteria and effective forms of recruitment could help to mitigate teacher shortages by expanding the pool of potential teachers and ensuring that those who are selected are a good fit for the profession.** The criteria used to select candidates should be presented in an attractive way compared with other professions of the same level. This means that the entry threshold should be effective, and the main requirements to enter the profession should be justified. Dee & Goldhaber (2017) discuss evidence that in the US, variation between states with regard to selection regulations (coupled with, for example, different seniority rules, specific licencing requirements) limits interstate teacher mobility. This limited interstate mobility complicates efforts to address teacher shortages: for example, surplus teaching labour in a subject area in one state cannot easily be transferred to a different state that is experiencing shortages in the same subject area. Some countries have designed 'match-making' portals that match available teachers with vacancies and streamline the application process. For example, a replacement pool for absent teachers has been proposed in Wallonia, while in Ireland, the Irish Primary Principals Network is launching a new centralised matching portal.

Second, **defining the criteria for selecting candidates in a way that is fair and objective, and making sure that these criteria are clear and communicated well to potential candidates, can improve the effectiveness of selection processes** (Kimbrel, 2019). Furthermore, this can help in attracting individuals who may not previously have considered teaching as a career. In the Netherlands, for example, a standardised competency profile is used to assess candidates for teaching positions. In Denmark, meanwhile, a points system is used. Points are awarded on the basis of factors such as academic qualifications, relevant experience and personal qualities, and the candidates with the highest scores are selected for interview. Dee & Goldhaber (2017) discuss some evidence as to how the effective use of data mining and social media could help schools to better identify promising potential teachers.

Third, teacher shortages can be mitigated through the use of effective forms of recruitment, such as short-term solutions. For example, **recruiting retired teachers or talented graduates/professionals from other fields for a fixed period can help in filling immediate staffing needs.** These (short-term) solutions can also attract

individuals who may be interested in teaching but are hesitant to commit to a full-time teaching position.

Fourth, **schools with good HR policies keep a continuous eye on recruitment and work preventively.** For example, recruiting teachers at the beginning of the academic year is a good HR practice, because it allows schools to attract a wider pool of highly qualified and motivated candidates. When schools have their vacancies filled early, this reduces the risk of having to hire teachers with lower qualifications or those who are less committed to the profession. Teachers who are hired early in the year have more time to plan their lessons, get to know their students, and build relationships with colleagues, leading to improved student outcomes and higher levels of job satisfaction among teachers. Furthermore, early recruitment allows schools to provide adequate support and resources to new teachers, which is crucial for their success and retention within the profession. In contrast, hiring teachers late in the year may lead to rushed decision-making, inadequate preparation, and a lack of support – all of which can contribute to poor teacher retention and negatively impact student achievement.

**Evidence.** Dee and Goldhaber (2017) argue that there is evidence to suggest human resources departments in US schools tend to lack proactivity, and often exhibit dysfunction with regard to the recruitment and selection of teachers. Numerous studies indicate that hiring teachers late in the academic year has adverse effects on teacher recruitment and retention, as well as student achievement. The percentage of newly hired teachers recruited after the commencement of the academic year varies annually and by geographical location, with estimates ranging between 11% and 30% (Engel, 2012; Jones et al., 2011; Liu & Johnson, 2006; Papay & Kraft, 2016). Using fixed-effects models, evidence shows that teachers who are hired after the beginning of the academic year are less efficient and more likely to exit the teaching profession compared with peers who were hired earlier (Jones et al., 2011; Papay & Kraft, 2016), as they have less time to prepare the curriculum, develop engaging lessons and fully understand school operations. Lastly, schools that hire teachers later may be left with a weaker pool of candidates, since the best-prepared teachers are more likely to have already secured employment elsewhere (Papay & Kraft, 2016).

Moreover, although it might seem contradictory, in many European countries (Greece, Italy, Liechtenstein, Lithuania, Montenegro, Portugal, Serbia, Spain) (Eurydice, 2021) and in the USA (Dee and Goldhaber, 2017), both shortages and oversupply<sup>24</sup> of teachers coexist. Consequently, there is a surplus of qualified individuals who have obtained a teaching degree but are unable to secure (or pursue) a teaching position. This suggests that there are ample opportunities for school systems to recruit qualified individuals from other occupations or activities who already possess the necessary credentials to teach (Dee & Goldhaber, 2017). Furthermore, improved hiring practices could potentially alleviate teacher shortages by expanding the pool of potential candidates beyond those who

---

<sup>24</sup> In cases of oversupply, there are too many qualified teachers (namely, those graduating from ITE and alternative pathways courses – see Sections 4.2 and 4.3 for more details on these two paths into teaching) in relation to the number of open positions available in schools. This may be due to, for example, systemic characteristics of a country's education system such as a freeze in the recruitment of permanent teachers (e.g. in Greece), a general oversupply in certain subjects or regions (e.g. in Portugal, Italy and Spain) (Eurydice, 2021), or better working conditions offered in other professions outside the education sector (Dee and Goldhaber, 2017).

followed the traditional ITE programmes, to include those who have followed an alternative pathway (see also Sections 2.6 and 4.2 for more details on attracting a more diverse teacher workforce, and on ITE-related characteristics, respectively). However, it is also important to evaluate whether all individuals who graduate from ITE programmes are willing to start teaching, and whether they possess the necessary qualities that predict high teacher effectiveness. Hiring effective teachers can be a challenging task, given the heterogeneity of hiring processes, the widespread lack of human resources training in schools, and the difficulty of defining those elements that can predict teacher effectiveness<sup>25</sup> (Kimbrel, 2019). In this regard, the literature suggests that hiring practices that employ a multi-step selection system have the potential to better match candidate teachers with schools (Kimbrel, 2019). In particular, Moore (2017) identifies three elements for an effective hiring process: (1) the identification of the key qualifications and prior experience necessary for success, based on resumé screening; (2) a structured interview process aimed at identifying attributes essential for success in the job; and (3) the inclusion of so-called “predictive hiring approaches” (Maynes & Hatt, 2013) such as demonstration lessons taught by candidates or task simulations, so that the decision is not exclusively based on resumé screening and interviews.

Lastly, in line with a global trend in the job market toward the use of social media for recruitment (see e.g. Madia, 2011; Koch et al., 2011), encouraging anecdotal evidence has been reported in relation to innovative recruitment practices in education in the USA. Examples include relying on data mining and analytics to guide early and effective recruiting (Flanigan, 2016), as well as using social media (e.g., Twitter, Facebook, LinkedIn) to find potential candidates (Wexler, 2016). In Europe, job portals have been widely used as a way to better match supply and demand for teachers. For example, a job portal exclusively dedicated to teaching vacancies in schools was introduced in 2011 in Slovakia (edujobs.sk). Similarly, in Flanders, the agency for employment and vocational training (VDAB) offers an online portal (vdab.be) at which job seekers can apply for open positions in multiple sectors, among them the education sector. All vacancies in schools are posted on this website.

**In summary, based on the available evidence, human resources practices in schools should be further updated to ensure they work more proactively. Improved hiring practices, including earlier and more proactive recruitment and the expansion of the pool of potential candidates beyond those with traditional teaching backgrounds, could help to alleviate teacher shortages.**

### 3.3 School autonomy over teacher remuneration

**Rationale.** On condition that schools have autonomy over hiring decisions, autonomy over teacher remuneration can be beneficial in mitigating teacher shortages for two reasons. First, this enables schools to more easily adapt remuneration to local labour market conditions, which is crucial in tackling teacher shortages (Loeb & Page, 2000). Second, schools are better informed about their teachers’ preferences for different job attributes,

---

<sup>25</sup> As observed by Hanushek & Rivkin (2007, p. 70), ‘traditionally accepted measures of teacher quality such as experience and years of schooling, are only weakly linked with student achievement; they are not reliable proxies for effective teaching’.

which are likely to be heterogeneous. Both advantages are especially relevant in education systems in which schools also have autonomy over hiring decisions, as in such settings principals can tailor remuneration to those teachers under consideration to be hired.

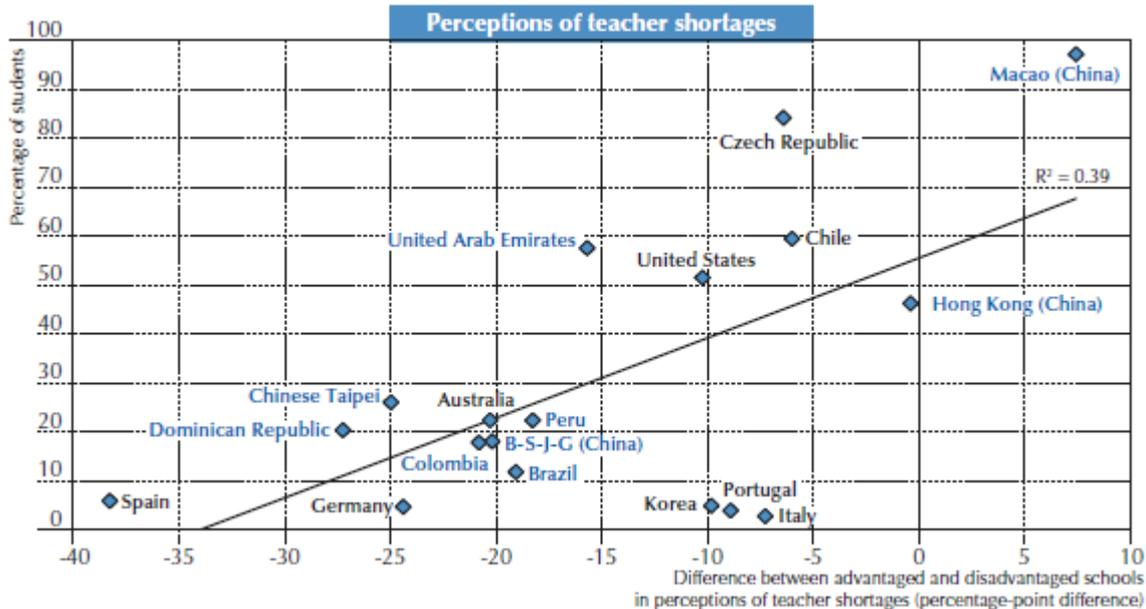
The effect on educational quality of a school's autonomy over remuneration is *a priori* unclear. Such autonomy can allow schools to reward good teachers with a higher salary, thereby increasing teachers' motivation. While differential remuneration could also reduce the motivation of lower-paid teachers (see Chapter 2), we would expect schools to take this into account in their salary-setting decisions. Despite its potential advantages, principals in most EU countries report having little autonomy over teacher remuneration, with the Netherlands, the Czech Republic and Sweden being notable exceptions (Pont et al., 2008). It should be noted that school autonomy over remuneration is less desirable in situations where schools with more disadvantaged students have lower spending power. In such cases, it might aggravate the inequitable distribution of teacher shortages between schools.

**Evidence.** Figure 7 shows how **countries with greater school autonomy over salary setting have a more equitable distribution of teachers between schools** (also with respect to teacher seniority), which can help to tackle teacher shortages. This evidence is only correlational, and should thus be considered with care.

More insightful are policy evaluations of reforms by which countries have decentralised responsibility for salary-setting. Two examples of this in recent decades are in Sweden and England. With regard to Sweden, Willén (2021) documents how the reform led schools to increase teachers' salaries at the cost of other miscellaneous educational resources (and to flatten the pay scale, as discussed in subsection 2.1.2.), especially where the local labour market offered more attractive alternative careers for teachers. These results suggest that centralised salary setting results in the misallocation of resources. However, the study did not find any significant effect on teacher recruitment or retention. In England, Burgess et al. (2022) also found that in areas where more attractive alternative careers available to teachers, schools increased their teachers' wages after being granted the autonomy to do so, and that this led to higher retention rates. These results also suggest that centralised salary setting results in a misallocation of resources. Biasi (2018) finds that a similar reform in Michigan prompted schools to pay higher salaries to teachers with a higher value-added, as measured by learning gains on standardised tests (despite not having access to these value-added measures), suggesting that decentralising teachers wage-setting can lead to higher wages for better teachers. It should be noted that the evidence from these three papers all comes from countries in which schools have a relatively high degree of autonomy over teacher hiring decisions.

**In summary, both theory and evidence suggest that schools having greater autonomy over teacher remuneration would lead to the more efficient allocation of resources, and could help tackle teacher shortages.**

Figure 7. Relationship between the difference in perceived teacher shortages between advantaged and disadvantaged schools, and the percentage of students in schools where the principal has considerable responsibility for determining increases in teachers' salaries



Source: OECD (2018).

### 3.4 School leadership

**Rationale.** Strong school leadership can be an important factor in mitigating teacher shortages. School leaders have the responsibility of supporting teachers and creating a positive organisational culture (Thomas et al., 2020). When school leaders are effective in these core tasks, teachers are more likely to feel supported and valued, which can increase teacher retention rates and attract new educators to the school. Research shows that school leadership is one of the most critical factors in a teacher's decision to stay at a school or leave. A study by Boyd et al. (2011) found that principals were the most important factor in determining teacher job satisfaction, with effective leadership being strongly associated with increased retention rates. Similarly, Brown and Wynn (2009) found that teacher satisfaction and retention were strongly linked to perceptions of the school's leadership. Effective school leadership can create a positive work environment that fosters collaboration, communication and a shared commitment to student success (Tuytens, Vekeman & Devos, 2023). **When teachers feel supported by their leaders, they are more likely to feel invested in their work and motivated to stay in their current position. Strong leaders can also help to create opportunities for professional development and growth, which can further enhance teacher satisfaction and retention. In addition to improving teacher retention rates, strong school leadership can also help to attract new teachers to the school.** When a school has a reputation for effective leadership and a positive organisational culture, it can be an attractive option for new educators who are seeking a supportive and fulfilling work environment.

**Evidence.** Johnston (2021) used a discrete choice experiment to estimate willingness-to-pay (in terms of equivalent salary) in relation to 13 job attributes among a large sample

of teachers in Texas. The paper found that having supportive principals was the most important job attribute, with a value equivalent to a 17.3% wage increase. For a sample of teachers in England, Burge et al. (2021) found that a supportive principal was equivalent to a 9.1% wage increase. In addition, Johnston (2021) found that a supportive principal reduced teachers' aversion to working in schools with more disadvantaged students. As with many other policy levers discussed in this report, **improving the quality of principals and tackling shortages of principals has the advantage of not only improving teacher retention, but also improving other educational outcomes, such as those measured by performance on standardised tests** (Miller, 2013; Meier & O'Toole, 2002).

Given the importance of principals to teacher retention, reports of principal shortages are worrying. In 15 out of the 22 education systems from OECD countries discussed in Pont et al. (2008), authorities report difficulties in finding enough candidates to fill job openings for principals, especially in urban areas and in primary education. **Making the job of a principal more attractive is thus one way to improve teacher retention.** Becoming a principal is considered to imply a large increase in workload and stress, without a proportional increase in remuneration (Tran, 2017). In many European countries, including Spain and Germany, the maximum salary for principals is 20-30% higher than the maximum salary for teachers. In the UK, the maximum salary of principals is 180% higher than that of teachers (Pont et al., 2008). Given the small number of principals in an education system relative to the number of teachers, **increasing the remuneration of principals would be much less costly, though no research has examined whether this policy measure would be cost-effective.** The salaries of principals in more difficult-to-staff schools are higher in only a few EU countries, such as France and Sweden (Pont et al., 2008). In France, this pertains to schools with a high share of disadvantaged students. Most research into the retention of principals focuses on the influence of personal characteristics (such as sex, experience and education) rather than on job characteristics that could be changed by policy (Rangel, 2018). Those studies that do focus on job characteristics consistently find that principals want greater job autonomy, and that those principals who indicate that have more autonomy are more likely to want to remain as principals, especially with respect to autonomy over the hiring and firing of teachers (Rangel, 2018). In contrast to principals' remuneration, increased job autonomy might be more affordable to governments under tight budget constraints.

While making the profession more attractive might solve the problem of a shortage of principals, it does not necessarily improve their quality. This would also require improvements to the hiring process (though this measure on its own might be less useful if there is a shortage of candidates anyway). Usually, a teaching certificate and work experience is required, although there are exceptions (like Sweden, Norway, and Portugal). Earlier research in the US has studied whether a principal with more experience as a teacher or with more experience as an administration is more likely to quit, but the results were contradictory (Rangel, 2018).

A different way of improving the quality of principals is through their professional development. This would be particularly important if schools' autonomy over human resource matters were increased. Pont et al. (2008) identify three types of professional development for principals: preparatory training for teachers; induction training for those

who have recently become principals; and in-service training. While many countries are making pre-service training mandatory for those who apply, induction and in-service training are rarely mandatory and their cost are sometimes borne by school development budgets (Pont et al., 2008).

Jacob et al. (2015) provide strong evidence regarding the possible effectiveness of in-service professional development for principals. In a large-scale, randomised controlled trial, they tested the effectiveness of the popular McREL Balanced Leadership<sup>®</sup> programme, which is targeted at improving pupils' achievement. They found that the programme significantly increased principals' self-efficacy, but that teachers did not notice any improvements around two years after the programme was completed. Given their increased self-efficacy, however, turnover among principals did decrease by 23 percentage points. However, the authors argue that at least part of this large effect could possibly be explained by the experimental setting, in which districts encouraged principals to stay so that the school could receive free professional development. As a result of the lower turnover among principals, teacher turnover also decreased by 7 percentage points. In short, while the programme did not significantly increase the quality of principals, it reduced turnover among both principals and teachers – possibly due to the improved self-efficacy of the principals.

**In summary, principals are crucial to tackling teacher shortages and improving educational quality. Policy measures that improve quality of principals and addressing shortages in principals could be a cost-effective solution, as there are simply not very many principals, and thus increases in salary or time for professional development would not be too costly. As with professional development for teachers, it is crucial that countries which see a large role for professional development in schools (among other ways of improving teacher and principal retention) focus on the quality of programmes and rigorously evaluate their effectiveness using randomised controlled trials that include outcome variables besides principals' own perceptions of the effectiveness of the programme.**

### 3.5 Induction, support and mentoring

**Rationale.** Induction, support and mentoring<sup>26</sup> programmes provide both novice and experienced teachers with the resources, guidance and professional development opportunities they need to become effective educators and make a positive impact on their students' learning and development (Ingersoll & Strong, 2011). Induction programmes typically provide new teachers with information about a school's culture, policies, procedures and expectations, as well as professional development opportunities to help them develop the knowledge, skills and attitudes necessary for effective teaching. Support refers to the resources and assistance that are provided to teachers to help them improve their practice and meet the needs of their students (see Darling-Hammond, 2006; Ewing & Smith, 2003; Ingersoll & Strong, 2011; Johnson, 2007; Smith & Ingersoll, 2004). Mentoring involves pairing a new or less experienced teacher with an experienced mentor

---

<sup>26</sup> Mentoring is usually a compulsory element of induction programmes. However, mentoring can also be made available to starting teachers in the absence of an induction programme, and to all serving teachers (with different experience) who are in need of support (Eurydice, 2018).

who provides guidance, support and feedback to help the new teacher develop their skills, confidence and capacity to maintain their well-being (Hobson and Maxwell, 2017; Kutsyuruba et al., 2019; Shanks, 2017). At the same time, mentoring can benefit not only novice teachers, but also experienced teachers and school leaders, who no longer have access to induction programmes (Campbell et al., 2017; Feiman-Nemser, 2012; Hobson et al., 2009a; Searby & Armstrong, 2016). Mentors can provide assistance with classroom management, lesson planning, assessment and other aspects of teaching, as well as offering emotional support and advice as needed (see Harrison, Dymoke, & Pell, 2006; Löffström & Eisenschmidt, 2009). **Thanks to induction, support and mentoring, teachers feel supported and valued, such that they might be more likely to remain in their positions and continue to develop their skills and expertise over time.** This can help to mitigate teacher shortages by reducing the need for schools and educational organisations to constantly recruit and train new teachers, which can be time-consuming and costly. Moreover, the learning curve of novice teachers is very steep, with significant gains during the first two years in the profession (Atteberry et al., 2013). By investing in developing and supporting their existing teacher workforce, schools can create a more stable and sustainable teaching environment that benefits both teachers and students. As it aims to reduce the likelihood of teachers dropping out of education, this could be a cost-effective measure.

**Evidence.** The literature points to mentoring and induction programmes as a cost-effective action to enhance retention rates among new teachers. **The empirical evidence on these actions shows that well-designed induction programmes for novice teachers not only result in more teachers remaining within the profession, as well as higher levels of well-being, but also accelerated professional growth among new teachers, and increased student learning** (Kutsyuruba et al., 2019; Ingersoll & Strong, 2011; Smith & Ingersoll, 2004; Villar & Strong, 2007). In particular, well-designed mentoring and induction programmes improve teachers' effectiveness by positively influencing their attitudes, sense of efficacy, and instructional abilities (Ingersoll & Strong, 2011). The elements of mentoring programmes that correlate most strongly with higher rates of teacher retainment are the presence of a mentor teacher in the same subject area, regularly scheduled collaboration with other teachers, and being part of an external network of teachers (Kutsyuruba et al., 2019; Smith & Ingersoll, 2004). In addition, Goldhaber et al. (2020) found evidence of a positive relationship between mentor effectiveness (using value-added measures) and mentees' value-added effectiveness in maths and English. **The literature also finds that programmes which last longer (at least two years) work best** (Ingersoll & Strong, 2011), although in practice these programmes often last 'only' one year (Helms-Lorenz et al., 2013). Furthermore, the initial practice of new teachers can be further improved if their mentors receive formal training and are partially freed up from their regular classroom duties. This allows mentors to provide one-on-one observation and coaching in the classroom, demonstrating effective teaching methods and assisting new teachers in addressing any practice-related issues they encounter (Olebe, 2001; Smith & Ingersoll, 2004; Wang et al., 2008).

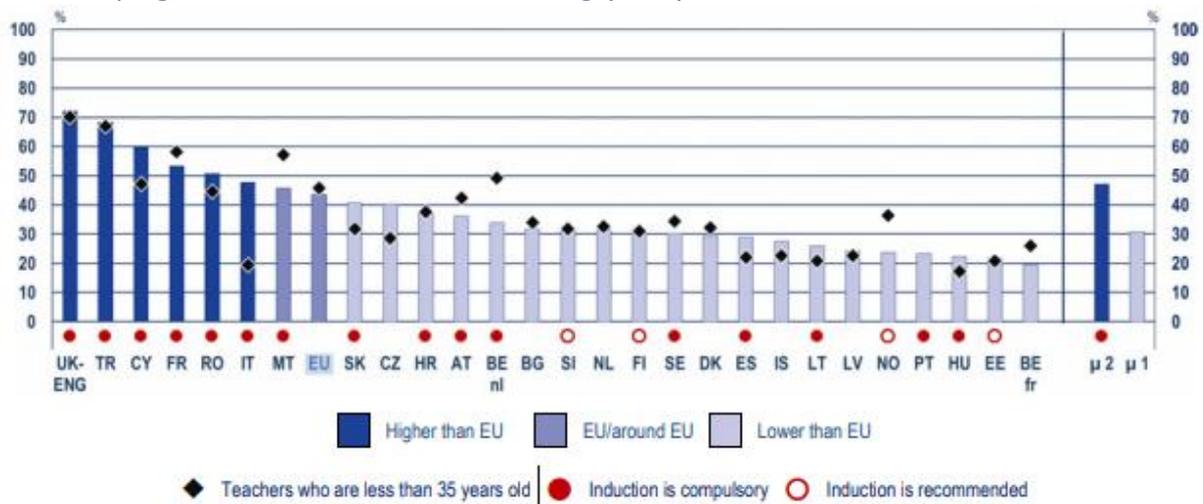
The offer of induction programmes to beginner teachers is common among European education systems that are part of the Eurydice Network (40), with teachers in 26 education systems having access to compulsory programmes. In Estonia, Slovenia and Finland, induction is recommended, while in the remaining 11 education systems induction

programmes are not regulated (Eurydice, 2018). In terms of duration, most induction programmes have to be taken within the first year, with the exception of Luxemburg (3 years), Germany (1-2 years), Ireland (3 years), Hungary (2 years), Malta (2 years) and Liechtenstein (3 years). With regard to mentoring, teachers entering the profession have access to mandatory mentoring in 28 education systems, while mentoring programmes are recommended in another five (Bulgaria, the Czech Republic, Cyprus, Latvia and Norway). In the remaining seven education systems, mentoring is not regulated (Eurydice, 2018). **However, as is clear from Figure 8, despite induction programmes sometimes being compulsory, their uptake in some education systems is very low.**

In terms of cost-effectiveness, induction programmes can yield a significant return on investment. In a medium-sized California school district, a comprehensive, two-year induction programme resulted in a significant return on investment after five years. The benefits were due to the improved effectiveness of novice teachers who had undergone induction, as they were found to teach as effectively as more experienced fourth-year teachers who had not received induction. In addition, the two-year induction programme led to reduced turnover and lower costs associated with the recruitment of new teachers. Overall, the study suggests that after five years, society enjoys a USD 1.66 return on every dollar invested in induction programmes (Villar & Strong, 2007).

**In summary, the implementation of longer-lasting induction and mentoring programmes (i.e. of at least two years) could be an effective policy measure in tackling teacher shortages, while also improving teacher effectiveness and lowering the costs associated with hiring (due to lower turnover rates).**

Figure 8. Proportion of lower-secondary education teachers who took part in formal or informal induction programmes as newcomers to teaching (2018)



Source: Eurydice, 2021, Figure 2.7.

### 3.6 Professional development of teachers

**Rationale.** Providing high-quality continuous professional development (CPD)<sup>27</sup> is widely considered to be a valuable approach to enhancing the performance of both teachers and students (Darling-Hammond, 2017). At the same time, **there has been a growing interest in CPD as a means of improving teachers' job satisfaction, while also having the potential to reduce their workload (due to higher teacher efficacy, improved teaching strategies, and enhanced subject and ICT knowledge) and, ultimately, improve teacher retention rates** (Coldwell, 2017). Currently, a wide range of CPD options are available to schools and teachers. However, the content and quality of these programmes varies considerably, as does their accessibility and teachers' involvement in them. This situation calls for high-quality research to investigate the effectiveness of various types of CPD initiatives (Compen et al., 2019). Furthermore, there is little evidence to suggest that these programmes have a significant positive effect on teacher retention (Glazerman et al., 2010; Humphrey et al., 2018). In almost all European countries, there is a statutory duty for teachers to participate in CPD. Thus, TALIS 2018 survey data reveal that 92.5 % of lower-secondary teachers in European countries had attended at least one type of CPD activity in the 12 months prior to the survey (Eurydice, 2021).

**Evidence.** On the one hand, CPD aims to improve teachers' self-efficacy and productivity which, in turn, can play a role in attracting and retaining teachers in the profession. Dixon et al. (2014) showed that engaging in more hours of CPD training on differentiated instruction was positively associated with enhanced self-efficacy, and in greater levels of the application of this practice in the classroom. Similarly, using a randomised experiment, Compen et al. (2020) found that engagement in online CPD<sup>28</sup> enhanced teachers' self-efficacy. Self-efficacy, or perceived teaching abilities, is an important motivation for entering the teaching profession (Fray & Gore, 2018; Struyven et al., 2013; Thomson et al., 2012). Furthermore, while no relationship could be found between general CPD training (including both pedagogical and subject-based training) and teacher productivity (as measured by value added to student achievement), subject-based CPD training alone were found to have positive effects on teacher productivity (Harris & Sass, 2011). In a systematic literature review, Ansyari, Groot and De Witte (2020) observed that the **key principles for effective CPD are its content focus, active learning, its duration, collective participation, coherence and ownership. As these authors show, CPD has an effect on teacher quality as measured by increased satisfaction, attitudes and beliefs. It is therefore likely that CPD improves teacher retention.**

According to data from TALIS 2018, the planning of CPD at the school level appears crucial to ensuring a balance between individual and organisational learning needs and in establishing priorities, as in those countries in which schools are required to have a CPD plan, teachers tend to participate in more diverse forms of CPD (Eurydice, 2021). Another study conducted in England (Allen & Sims, 2017) found that teachers' participation in a high-quality CPD programme organised for STEM teachers (i.e. subject specific CPD) could

---

<sup>27</sup> CPD is a form of in-service training that teachers engage in throughout their careers to expand, develop and refresh their knowledge, skills and attitudes. CPD can take various forms, as it can be formal and informal, and can include both subject-specific and pedagogical training (Eurydice, 2021).

<sup>28</sup> Given the high (opportunity) costs of traditional CPD training, online CPD might provide a cost-effective alternative (Compen et al., 2020).

contribute to retaining teachers in the profession. In particular, while participation had no significant impact on retaining teachers in their current school, participating teachers were more likely to continue working within the teaching profession for the first and second year after completing the CPD course (i.e. the odds of them remaining in the profession were 160% higher than for similar non-participants). Meanwhile, Worth & Van den Brande (2020) found a positive correlation between teachers' self-reported autonomy over their professional development and their desire to remain within the teaching profession. While this study did not establish a causal relationship, it points to the need for further investigation into whether enhancing teachers' autonomy with regard to CPD could represent a viable approach to improving retention rates. Lastly, the literature points to a positive correlation between practices of shared leadership by the principal (for example, involving co-decision on the kinds of CPD courses to be followed by teachers) and enhanced teacher professional learning (Poeckert, 2012; Grenda & Hackman, 2014).

**In summary, given the little evidence available, stimulating continuous professional development could represent an effective way to increase retention of teachers. The literature points to the conclusion that, in order to be effective, professional development activities should have a high content focus, involve active learning, have a sustained duration, provide collective participation, and offer coherence and ownership.**

### **3.7 Networked schools – professional learning communities**

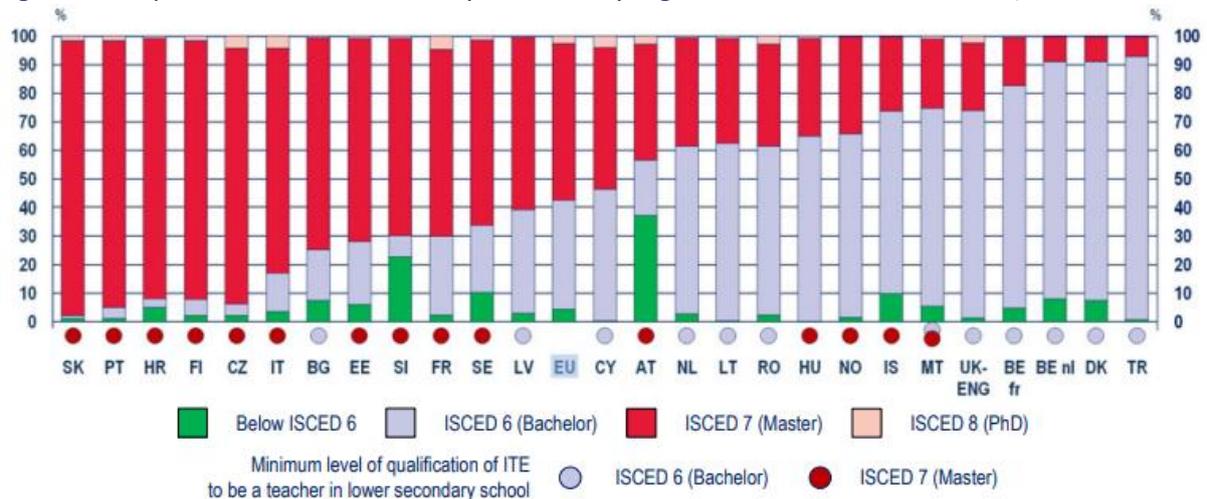
**Rationale.** Mitigating teacher shortages goes beyond an individual school. Schools, school leaders and teachers should all collaborate. Professional learning communities<sup>29</sup> (PLCs) and collaborative teaching (see Section 3.8) can help to mitigate teacher shortages by promoting collaboration among teachers and allowing them to share resources, ideas and responsibilities (Wynn, 2007). This can result in the more efficient use of time and resources, increased job satisfaction and self-efficacy (Yoo & Jang, 2022), collective efficacy (Voelkel & Chrispeels, 2017), and improved student outcomes (e.g. Vescio et al., 2008). In addition, heterogeneous groups of teachers (e.g. those with a mix of Bachelor's and Master's, differing seniority and expertise) can also be beneficial by bringing together individuals with diverse backgrounds, skills and perspectives.<sup>30</sup> It can be hypothesised that teachers with more experience can mentor and guide newer teachers, while teachers with different degrees and specialisations can bring unique perspectives and subject expertise into the classroom. Moreover, having a diverse group of teachers can also promote collaboration and innovation in teaching practices. By working together, teachers can share their skills and knowledge and develop new strategies to improve student learning. This can lead to a more engaging and effective learning environment, which may attract more teachers to the profession. In practice, Figure 9 shows that in most countries, there is a limited heterogeneity in the educational levels of teachers. This obviously relates to teachers' remuneration (see Chapter 2).

---

<sup>29</sup> PLCs are one example of structurally organised teacher collaboration. Teachers in PLCs meet regularly, share expertise and work collaboratively to improve their teaching skills and hence, student achievement (e.g. DuFour, 2004).

<sup>30</sup> It is worth mentioning that in Finland, the teaching profession is held in high esteem, and it is mandatory for school teachers to possess a Master's degree, while ECEC teachers must hold a Bachelor's degree.

Figure 9. Proportion of lower-secondary teachers by highest educational attainment, 2018



Source: Eurydice, 2021, Figure 2.2.

**Evidence.** Teacher collaboration is a crucial element in improving the quality of school education and thus student achievement (Goddard et al., 2007). As one specific form of collaboration, PLCs are considered an effective form of collaborative teacher groups (Ninković et al., 2022). While the past decade has seen a shift from within-school to between-school PLCs, little systematic evidence is available on their effectiveness. Using a mixed-methods approach, Prenger et al. (2018) examined the effects of 23 networked PLCs in the Netherlands, and found small positive effects on teachers' perceived satisfaction and in the knowledge, skills and attitudes they developed. Furthermore, **PLCs can play a role in retaining beginner teachers, as they draw on elements similar to those in mentoring programmes that were found to correlate most strongly with higher rates of teacher retention.** Such elements include regularly scheduled collaboration with other teachers, and being part of an external network of teachers (Smith & Ingersoll, 2004). In particular, PLCs enhance collaboration (i.e. the sharing of expertise, sense of affiliation, shared understanding), promote shared norms and values, and allow the de-individualisation of the teaching practice (through, for example, the observation of other teachers' practices, and the exchange of roles) (Kruse et al., 1995; Louis et al., 1996). In addition, beginner teachers especially value the supportive conditions enhanced by PLCs, such as the presence of human and material support during the first stages of their career (Hord, 1997). In Europe, the concept of networked schools fits in seamlessly with the Erasmus+ initiative, and before it, the Comenius programme (2007-2013). In particular, the platform eTwinning – the learning community for schools in Europe – enables teachers from around Europe to connect, share best practices and develop collaborative projects.

**In summary, given the little evidence available, it appears that teacher collaboration (e.g. in professional learning communities) results in the increased retention of teachers. While no formal policy evaluations are available, given the fact that teacher collaboration draws on aspects similar to those in mentoring programmes, promoting PLCs could be an effective policy measure to tackle**

**teacher shortages while also improving teacher effectiveness and lowering the costs associated with hiring (due to lower turnover rates).**

### 3.8 Collaborative teaching

**Rationale.** Collaborative teaching, co-teaching or team teaching is an innovative staffing model in schools. It allows two or more teachers to work collaboratively to plan, deliver and evaluate instruction. This model provides students with the benefit of having multiple teachers with different backgrounds, skills and areas of expertise in the classroom.

Collaborative teaching (co-teaching) can lead to the more efficient use of resources, and enables teachers to share their expertise (Veteska et al., 2022). First, **teachers can share their preparation and evaluation methods, materials and expertise, reducing the need for each teacher to create everything from scratch.** This sharing of resources can save time and reduce workload, enabling teachers to focus more on teaching and supporting students. As workload is one of the main reasons why many teachers leave the teaching profession, collaborative teaching might increase retention rates.

Second, team teaching allows for more personalised instruction and better differentiation, as teachers can work together to tailor instruction to the needs of individual students<sup>31</sup> (Veteska et al., 2022). This can result in improved student learning outcomes and greater student engagement in the classroom (Murawski & Swanson, 2001).

Third, **team teaching can create a supportive and collaborative environment for teachers, fostering professional growth and development.** Through the promotion of mutual learning, teachers can learn from one another, share best practices and collaborate on new approaches to teaching and learning (Baeten & Simons, 2014).

Fourth, team teaching can allow **larger class sizes, because multiple teachers are able to work together to manage a larger group of students.** This approach can be effective when teachers are able to work together seamlessly, sharing responsibilities and using their combined skills and knowledge to provide high-quality instruction to students.

However, for team teaching to be effective with larger class sizes, several conditions must be met. First, the teachers must have a clear understanding of their roles and responsibilities, as well as how they will work together to manage the larger group of students. They must be able to communicate and collaborate effectively to ensure that instruction is consistent and well coordinated. Second, the teachers must be well trained in the team teaching approach (Damore & Murray, 2009), including how to manage larger classes, how to work together effectively, and how to provide individualised instruction to students within the larger group.

**Evidence.** Staffing models that include collaborative teaching have the potential to be a cost-effective intervention. These can do this by, for example, harnessing the expertise of senior teachers by allowing them to lead lessons across several classrooms, in collaboration with less experienced teachers (Bryant et al., 2023). Based on a discrete choice experiment

---

<sup>31</sup> In this regard, the origins of co-teaching can be found in inclusive schools, where cooperation was sought between teachers of special and general education to improve the personalised instruction of special needs students (Friend, 2015).

carried out among early-career teachers in Australia, Burke et al. (2015) found that starting teachers with intentions to leave the profession placed greater relative value on resource sharing, cooperative planning, co-teaching and discussions outside teaching hours about classroom management (i.e. they favoured professional support that focused on their immediate needs for classroom teaching). Meanwhile, early-career teachers with intentions to remain in their school were found to place greater relative value on observation from and discussions about teaching with more experienced teachers (Burke et al., 2015).

On the other hand, **co-teaching can be a cost-effective solution as it can exploit the economies of scale that arise from the management of larger classes, which free up resources that can be used to recruit and retain highly effective teachers** (Chingos, 2011). To facilitate effective collaboration (which is required for the successful implementation of co-teaching), common planning time and flexibility, as well as matching teaching styles and curricular accommodation are needed (Bouck, 2007). Despite co-teaching's potential for cost-effectiveness, very limited empirical evidence is available to support the effectiveness of co-teaching on student achievement. That evidence which is available concentrates mainly on the effectiveness of co-teaching in inclusive education. (For a review of co-teaching in special education settings, see King-Sears et al., 2021). Furthermore, no empirical evidence is available with regard to co-teaching's impact on retention rates. This might be an issue if classes become too large and heterogeneous.

Lastly, collaborative teaching might be an effective staffing method to improve the induction of novice teachers in education (see Section 3.5).

**In summary, given the little evidence available, it would be advisable to favour co-teaching in schools that are experiencing teacher shortages, as it would allow class sizes to be increased. However, if classes become too large, the workload of co-teachers might increase such that retention rates decrease. Furthermore, to make the most of co-teaching's potential to mitigate teacher shortages, teachers need to be trained on how to best adapt their teaching methods to a co-teaching environment.**

## Chapter 4. System-level interventions

This chapter shift its focus to system-level interventions, which have emerged as a critical component of comprehensive solutions to support teacher-level and school level interventions. Such interventions involve addressing the structural and systemic factors that contribute to teacher shortages, including the lack of career diversification, limited opportunities for teachers' professional growth and mobility, and issues in ITE. Specifically, Section 4.1 explores the diversification of career structures through the introduction of a multi-level career structure, facilitating task differentiation and mobility across subjects and educational levels, and promoting hybrid teachers. Sections 4.2 and 4.3 examine ITE and the role of alternative paths into teaching. Lastly, Section 4.4 discusses the use of ICT and its potential to improve the effectiveness and efficiency of teacher training and support. We discuss whether these interventions offer promising pathways towards addressing the complex challenge of teacher shortages.

### 4.1 Diversification of career structures

Diversifying one's careers in the teaching profession refers to the process of expanding one's skills, experiences, roles and responsibilities. This can involve pursuing new opportunities within the field of education (e.g. as a member of an education inspectorate, school head, student counsellor, mentor to other teachers, Erasmus+ project coordinator) or exploring career paths that lie outside of education altogether. Traditionally, the teaching profession has been seen as a linear career path, with educators progressing from entry-level teaching positions to more advanced roles within the same field, although not all countries have such a multi-level career structure. In recent years, there has been a growing recognition of the benefits of diversifying one's career within the teaching profession (OECD, 2005; OECD, 2019a). The diversification of teachers' careers can potentially mitigate teacher shortages, as it attracts a broader pool of candidates, improves teacher retention, and brings new ideas and approaches into education. The last of these effects can improve the efficiency of education. There are many ways to diversify teachers' careers, from engaging in research and policymaking, to pursuing educational leadership roles, moving between schools or subjects, and developing education technology. Below, we discuss the rationale and evidence behind three main possibilities.

#### 4.1.1 Introducing a multi-level career structure

**Rationale.** It is possible for countries to create a multi-level career path for teachers, allowing them to progress to positions that entail greater complexity and responsibility, all the while retaining their teaching role. Young (and ambitious) people who are considering teaching can be put off by the perception of it being a 'flat' career. In De Cort & De Witte (2023b), only 7% of Flemish students in ITE felt that teaching offered a lot of opportunities for career advancement, while 53% stated that the alternative career they were most strongly considering offered a lot of opportunities for career advancement. **Limited opportunities for career advancement is one of the reasons for leaving the profession cited most often by older teachers** (OECD, 2005). **An additional advantage of introducing a multi-level career is that these more advanced teaching roles have a higher status** (Dolton et al., 2018). **This might attract**

**potential teachers or help to retain current teachers who care relatively more about their social status, such as high-performing students.**

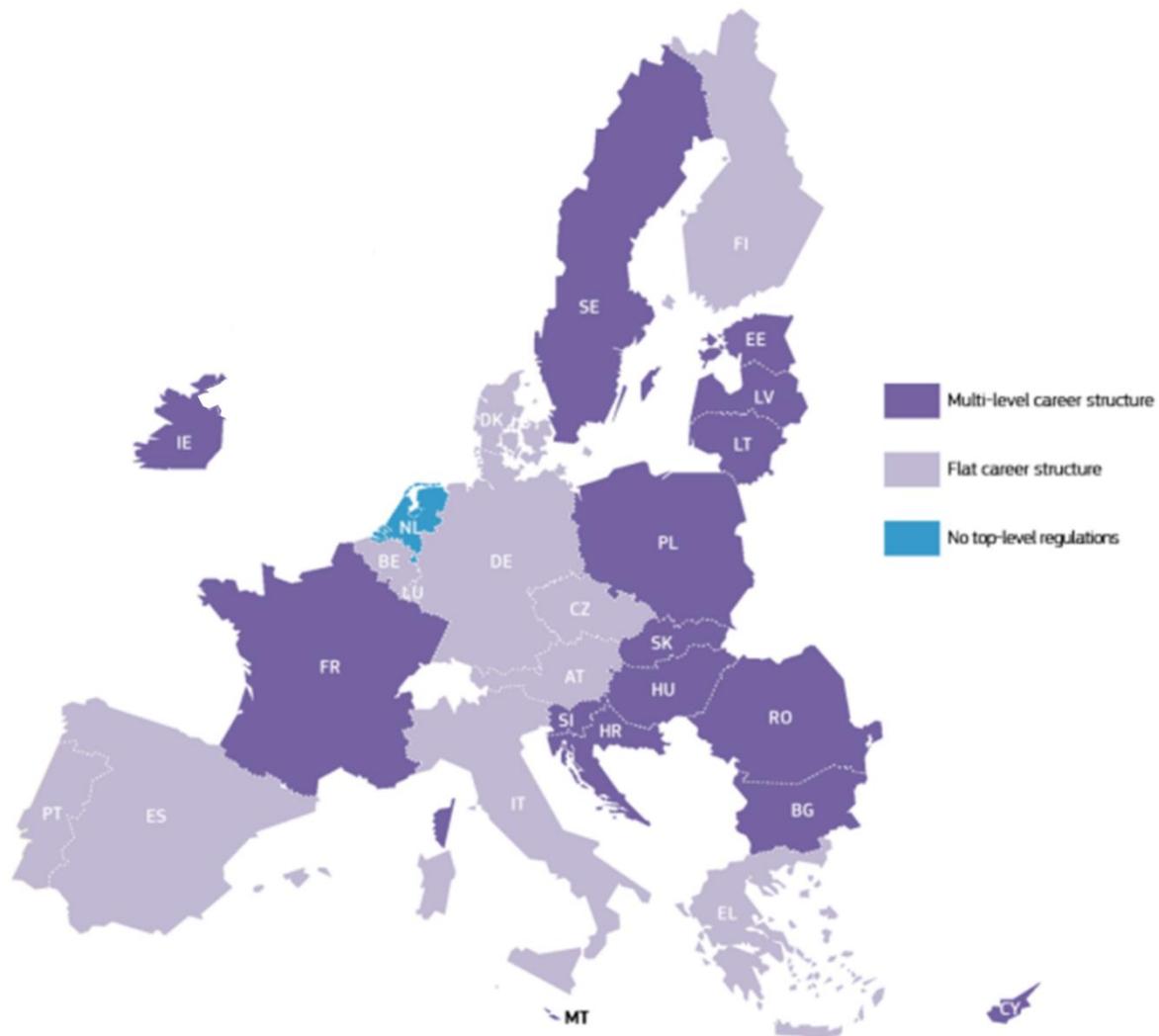
Despite the advantages mentioned above, and despite European attention towards national career frameworks, only around half of EU countries possess such a multi-level career structure for teachers (see Figure 10). The most common requirements for promotion are a positive evaluation, a minimum length of professional experience, a demonstration of specific competences, and having followed specific professional development courses (Eurydice, 2018). In almost all countries where they exist, more advanced teacher positions pay a higher salary to compensate for their increased responsibilities (Eurydice, 2018). So, introducing a multi-level career structure would require an increase in spending on teachers' salaries. **An advantage of introducing a multi-level career structure is that, depending on its design, this additional salary need not be paid to all teachers.** It can thus be conceived as a targeted financial incentive, possibly attracting teachers who, were it not for this career advancement opportunity, might have left the profession. Some countries have introduced a multi-level career structure during the last two decades. For example, the Netherlands introduced specialist teachers in primary schools who focus on developing the curriculum on a certain topic (such as mathematics) and supporting colleagues (European Commission, 2017).

The cost-effectiveness of introducing a multi-level career structure depends on its design (mostly, the salary increase and how many teachers will advance to these higher salary scales); how much more attractive the structure makes the teaching profession; and how it might affect educational quality (for example, by attracting more high-quality teachers to the profession).

**Evidence.** While there are many reasons for introducing a multi-level career structure, no research has systematically evaluated its cost-effectiveness in tackling teacher shortages. Such cost-effectiveness would depend on the system's design, including the additional salaries paid to the teachers in more advanced roles, the number of teachers that can advance to those roles, and how much more attractive the new career structure makes the teaching profession. Kyriacou and Coulthard (2000) found that 54% of English and Norwegian students in ITE rated 'good promotion prospects' as especially important in their career choice, while only 6% rated it as unimportant. Only De Cort & De Witte (2023b) quantify the increased attractiveness of the teaching profession after introducing a multi-level career structure, using a discrete choice experiment. They estimate that Flemish students in ITE, whose prospective teaching career is 'flat', value **being able to advance to a senior teacher role equivalently to a 3.5% increase in starting salary.**

**In summary, introducing a multi-level career structure in countries with a flat career structure could be an effective policy measure to tackle teacher shortages. Opportunities for career advancement, which are currently low, are found to be important in people's choice of career –and in particular, might help to attract and retain different profiles. Whether such a policy measure is cost-effective would depend crucially on its design, however.**

Figure 10. Types of career structure for fully qualified teachers in primary and general secondary education in EU Member States and the UK (2016/2017).



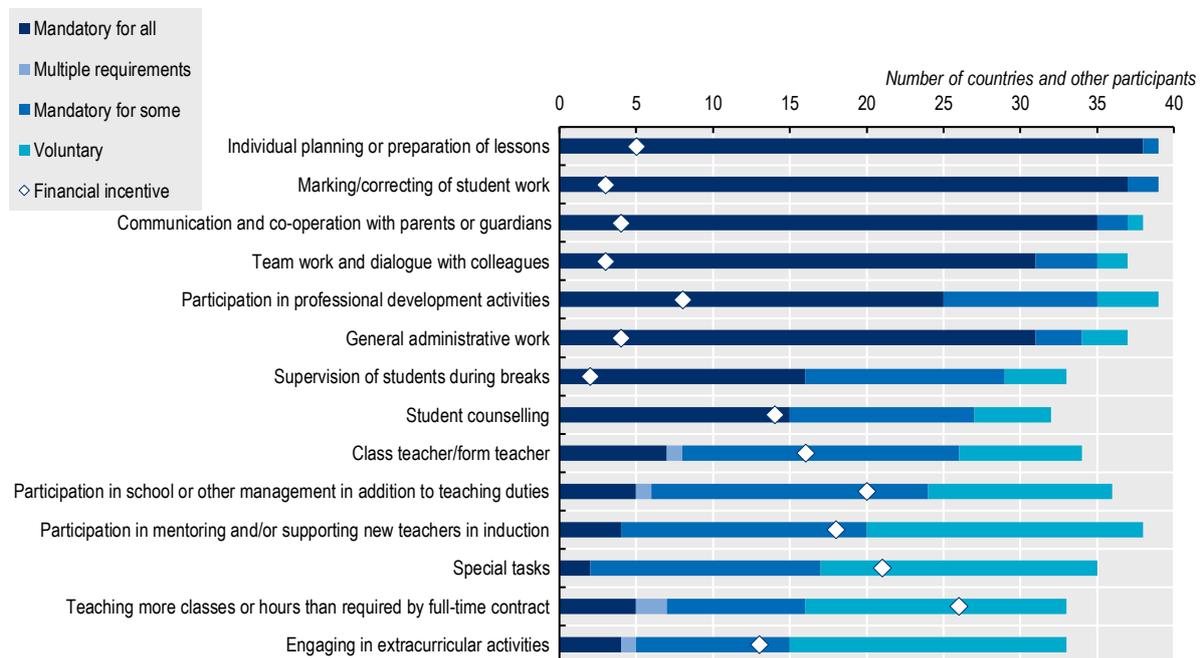
Source: Eurydice (2018). Career structure defined by the top-level education authority. In some Länder in Germany, ISCED 1 and 2 teachers may be promoted within a two-level career structure (grades A12 and A13). This type of promotion, limited to some Länder, is not taken into account here. In the Netherlands, social partners set the framework for a multi-level career structure through collective agreements. School boards are responsible for its interpretation and adaptation at school level. In the UK, the multi-level career structure applies to England, Scotland and Wales, whereas Northern Ireland has a flat career structure. In Latvia, the voluntary quality level system is linked with rewards for qualitative work.

#### 4.1.2 Facilitating task differentiation and mobility between subjects and educational levels

**Rationale.** Task differentiation refers to the possibilities for teachers to carry out different tasks according to their preferences and skills. This can refer both to different teaching tasks, such as guiding workplace learning or providing additional tutoring, and to non-teaching tasks such as student counselling, mentoring early-career teachers or coaching sports teams (Monard, 2009). **Such opportunities can provide educators with new perspectives and skills that they can bring back to the classroom, helping them**

**to remain engaged and fulfilled in their work.** Task differentiation is already present in schools, with tasks either being specified in teachers’ contracts (such as providing mentoring to new teachers, student counselling or being a class teacher in some countries), or are taken up on a voluntary basis (OECD, 2022). However, these additional tasks are not always compensated, either in the form of additional remuneration or in reduced teaching time, and teachers and schools are sometimes limited in their ability to divide these tasks (OECD, 2022). Figure 11 shows the number of OECD countries in which different tasks carried out by upper-secondary teachers in public institutions are included in their contracts (‘mandatory for all’); in how many they are mandatory at the discretion of individual schools (‘mandatory for some’); and in how many they are carried out voluntarily (together with an indication of whether a financial incentive is provided). Increased flexibility for schools over the structuring of teachers’ contracts could facilitate task differentiation that improves teachers’ job satisfaction in a cost-effective way, analogous to previous arguments regard autonomous HR policies at school level. For example, in around half of OECD countries, supervision of students during breaks and students counselling is a mandatory part of teachers’ jobs for which they receive no compensation. Flexible teacher contracts and, more broadly, an autonomous HR policy, would allow schools to allocate these tasks to those teachers (or assistants) who are most willing or most capable of carrying them out.

Figure 11. Task requirements of teachers



Source: OECD, 2022

In a similar manner to task differentiation, mobility between subjects (particularly in primary education) and educational levels can provide educators with new perspectives and skills that they can bring back to the classroom (for example, by promoting a learning culture in schools and by improving the continuity of the curriculum between different subjects and educational levels), helping them remain engaged and fulfilled in their work. Current career advancement opportunities mainly involve additional responsibilities outside

of teachers' core responsibility of teaching (such as coaching new teachers or working on school-level policy), which not all teachers may be interested in. Increased mobility has been promoted in particular by the Dutch educational Council (Onderwijsraad, 2018). It argues that mobility can also be a way to tackle teacher shortages in specific subjects or educational levels, as teachers in subjects or educational levels in which there is an oversupply can be retrained for subjects and educational levels in which there is a shortage of trained teachers (subject to them having sufficient content knowledge). The underlying reasoning behind this is that there is a large shared fundamental skill set that is essential to teaching, regardless of the subject or educational level being taught (Onderwijsraad, 2018). To promote mobility between subjects and educational levels, the Dutch Educational Council recommends (i) simplifying teachers' qualification structure by having fundamental courses on pedagogy and didactics shared by as many programmes in ITE as possible; (ii) providing extra time for professional development to in-service teachers and (iii); and as far as possible, equalising remuneration between teachers of different subjects and at different educational levels. This last measure aims to prevent asymmetric mobility, whereby teachers move to higher education levels as these usually result in a higher salary, which might create teacher shortages in primary education. This would not only be very expensive; it also runs counter to the reasoning set out in Section 2.2., which describes the advantages of targeted financial incentives that take into account opportunity costs (i.e. the wage one could earn outside of education), which are higher for some subjects and education levels than they are for others. In addition, providing extra time for professional development while keeping students' learning time constant would result in a greater demand for teachers, potentially aggravating teacher shortages. The desirability of the proposed reform package would thus depend on whether the ratio of its costs (mostly arising from equalising the remuneration of different teachers and providing additional time for professional development) to the increased attractiveness of the teaching profession and its effect on educational quality.

**Evidence.** Little research has been carried out to assess the (cost-)effectiveness of policy measures that facilitate task differentiation or mobility between subjects and education levels. With regard to facilitating teacher mobility, the Dutch Educational Council cites evidence of enthusiasm from stakeholders who were consulted, but has not attempted a quantitative evaluation of either the reform's costs or its benefits. Aubusson et al. (2004) qualitatively analysed a small-scale project in Australia that attempted to retrain in-service teachers from different backgrounds with respect to both subjects and education levels, to become physics teachers. The authors conclude that: (i) the pool of teachers with the high level of enthusiasm and dedication necessary for retraining to be a success is likely to be small; and (ii) the time, effort and money invested was too high for the intervention to be a cost-effective way of tackling specific teacher shortages.

**In summary, there is a case to be made for increasing teacher mobility (e.g. through Erasmus+, or during ITE) and particularly for promoting task differentiation, but there is no strong evidence that these are (cost-)effective ways of tackling teacher shortages. Specifically with regard to increasing teacher mobility, equalising remuneration for teachers to avoid asymmetric mobility towards better-paid levels of education can be very expensive, and limits the possibilities for targeted financial incentives towards hard-to-staff subjects. Countries that are interested in promoting teacher mobility should first measure**

**whether there is a sufficient interest in mobility between educational levels and subjects to potentially justify its large costs.**

#### **4.1.3 Promoting hybrid teachers**

**Rationale.** In this report, 'hybrid teachers' refers to teachers who combine a part-time job as a teacher with a different part-time job.<sup>32</sup> The possibility to work as a hybrid teacher might prevent in-service teachers who are looking for a different challenge from leaving the profession. In addition, the possibility of working as a hybrid teacher might attract people to the profession who might otherwise not have considered it, or who want to maintain a part-time job outside education (e.g. because of the additional challenges, the remuneration, or their network). In the Netherlands, 13.6% of Dutch teachers have a second job (Dorenbosch et al., 2018). With respect to educational quality, hybrid teachers can bring different skills, knowledge and networks to the classroom, with potentially positive effects on educational outcomes (De Witte & Iterbeke, 2022). **Hybrid teachers might be particularly interesting for technical and vocational education, where teachers are typically older than in other subjects and where advanced practical experience is required** (De Witte & Iterbeke, 2022). For technical and vocational teachers, (industry) experience is more important to educational outcomes than for traditionally licensed teachers (Chen et al., 2022). Furthermore, the subject matter in VET schools needs to follow new developments in industry, which could be facilitated by having teachers who also are working outside of schools (analogous to the reasoning in favour of workplace learning by students). Examples of hybrid teachers can be found in the Netherlands, where it is considered a way to deal with the acute shortage of qualified teachers. Primary schools invite external professionals such as artists, musicians and technicians to provide instruction for a short time period.

**Evidence.** No research has systematically evaluated how the promotion of hybrid teaching would affect teacher shortages or educational quality. Using correlational evidence, hybrid teachers in Canada and Switzerland have been found to have lower job stress, burnout and/or turnover intentions (Jamal et al., 1998; Sappa et al., 2015). As these symptoms have been shown to correlate with teacher absenteeism (Carrizosa & De Witte, 2023), hybrid teaching might also mitigate teacher shortages indirectly. With respect to its effect on teacher shortages, Dorenbosch et al. (2018) found that two out of three teachers would consider becoming a hybrid teacher. For 58% of these teachers, personal development and increased variation in tasks would be the prime motivations. Of these teachers, 37% said that they would be most motivated by additional salary and/or job security. In addition, **one in three students and one in three higher educated employees would be more interested in becoming a teacher if they could be a hybrid teacher**, and that this was more motivating than combining teaching with school-level managerial or pedagogical responsibilities. The fact that the working and student population are significantly larger than the teaching population suggests that the overall effect of promoting hybrid teaching would be positive. However, these are only stated intentions, and the two sets of questions were different. Two out of three teachers stated that they 'would consider becoming' hybrid teachers, while students and tertiary-educated workers stated that they would be 'more

---

<sup>32</sup> We are thus not referring to so-called 'moonlighters' who combine a full-time job with a second job for financial reasons (Wilsenky, 1963). The concept of hybrid teaching is also unrelated to whether the teaching is carried out online or offline.

interested in becoming' a teacher – a difference that is particularly important, as the step into hybrid teaching is much larger for those in the labour force than for teachers, as those in the labour force would need to obtain an additional degree. Lastly, Dorenbosch et al. (2018) also carried out a qualitative study to gather the perspectives of school leaders on hybrid teaching. The school leaders interviewed saw potential advantages in terms of the increased retention and motivation of in-service teachers, but said they would like to see a maximum of between 5 and 25% of hybrid teachers in their school, for reasons such as reduced flexibility in scheduling classes and fewer opportunities for collaboration.

**In summary, hybrid teaching is a career path that could make the teaching profession more attractive to outsiders, and could increase teacher retention. The available evidence is very limited, but suggests that its net effect would be positive (i.e. more people from outside of teaching than in-service teachers would become hybrid teachers). Further research on the topic and its effect on educational quality would be worthwhile.**

#### **4.2 Improving enrolment and retention strategies for initial teacher education (ITE)**

**Rationale.** Access to the teacher labour market in each country is determined by the rules of that country's teacher certification system. These systems usually require prospective teachers to graduate from an approved ITE<sup>33</sup> programme. Two main ITE models can be distinguished: concurrent and consecutive. The former allows a more integrated learning experience – including general academic subjects alongside pedagogical and professional subjects; the latter offers more flexible entry into a teaching qualification, as individuals who have graduated in a particular field can move into teacher training at a later stage (Musset, 2010). Multiple elements contribute to the **attractiveness of the teaching profession**, such as **the quality of ITE programmes**; the opportunity costs incurred as a consequence of enrolling in ITE versus pursuing another university degree (i.e. the wage one could earn after graduating outside of education, which are higher for some subjects such as STEM, and for some education levels more than others); as well as the extra cost in terms of "lost time" borne by ITE graduates in certain Member States (e.g. Croatia, Germany, Italy, Slovenia, Spain) where teachers have to pass a state or a national professional examination before gaining a position in schools. Shortages of students in ITE<sup>34</sup> are reported in 19 European education systems.<sup>35</sup> Depending on the specific country, these are due to high rates of students dropping out of ITE, low rates of students enrolling in ITE, or a combination of both (Eurydice, 2021). To build a strong teacher workforce and ensure that those who enrol in ITE are a good fit for the profession (which, in turn, can help to mitigate teacher shortages), reliable selection methods for ITE could be considered.

---

<sup>33</sup> ITE programmes represent the first step in a teacher's career, and are often referred to as the 'traditional pathway', compared with so-called 'alternative pathways into the teaching profession' (see Section 4.3).

<sup>34</sup> These are: Belgium (French and Flemish Communities), Denmark, Germany, Estonia, France, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Portugal, Sweden, the United Kingdom (England and Scotland), Iceland, Norway and Serbia.

<sup>35</sup> Belgium (French and Flemish Communities), Denmark, Germany, Estonia, France, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Portugal, Sweden, the United Kingdom (England and Scotland), Iceland, Norway and Serbia.

**Evidence.** Overall, the literature suggests that the certification of teachers is associated with higher teacher effectiveness (for a review, see Santiago, 2022, p. 87). Moreover, European evidence suggests that both in-service teachers and students in ITE and tertiary education consider 'initial teacher education adapted to the real job' to be one of the most effective means of enhancing the appeal of the teaching profession (Carlo et al., 2013). Other ways to improve attitudes towards employment in the teaching profession from an early stage, leading eventually to an increase in the number of enrolments in ITE, could include the use of promotional campaigns (De Cort & De Witte, 2023b) (for further discussion, see Section 2.5); the offer of scholarships (Liou et al., 2010); or the collaboration between universities and secondary schools (Carothers et al., 2019). Furthermore, the literature suggests that higher levels of support during both the ITE study programme and school placements (from tutors, higher education institution staff and school mentors) can decrease the likelihood of student attrition from ITE (Basit et al., 2006; Hobson et al., 2009b). In a longitudinal survey study of students enrolled in ITE in the UK, Hobson et al. (2009b) also point to the importance of the course workload as a way to increase both the appeal of and retention in ITE programmes. Although it is acknowledged that reducing the overall workload of ITE programmes might not be feasible or even desirable (as it might come at the cost of quality – Keane et al., 2022), Lin et al. (2016) suggest offering ITE students the option of extending their studies over a longer duration, as a way to enhance retention rates.

Compared with alternative pathways into teaching, the literature investigating differential retention rates between teacher education routes indicates that teachers who undergo ITE are likely to stay longer in the profession (see Connelly & Graham, 2009; Raymond et al., 2001). In particular, Connelly & Graham (2009) found that substantial pre-service student teaching experience has a strong effect on the likelihood that a beginner teacher of students in special education will remain in the field a year later. However, while ITE is usually seen as a way to train quality teachers, with the exception of mathematics teaching, the evidence does not find a consistent relationship between certification and teacher effectiveness, as measured by value-added measures (Clotfelter, Ladd, & Vigdor, 2010; Dee & Cohodes, 2008; Goldhaber & Brewer, 2000). A review by Coenen et al. (2018) confirms that subject-related degrees and knowledge, rather than general teacher qualifications, matter more to student performance. Furthermore, while the literature finds no significant positive relationship between a teacher's level of education (Master's vs. Bachelor's degree) and student achievement (Coenen et al., 2018), subject-specific Bachelor's/Master's degrees (with majors in maths or science) are found to correlate positively with student achievement in maths and science (Goldhaber & Brewer, 1996, 1997, 2000; Rowan et al., 1997).

Lastly, selection effects into the profession play a role in teachers' effectiveness. Cavalluzzo et al. (2015) suggest that there are signalling and screening effects in pursuing the National Board Certification (NBC, the most advanced ITE programme in the US), but the process of becoming NBC-certified has no actual effects on teacher effectiveness. In this regard, using a randomised experiment, Cantrell et al. (2008) find that teachers who applied unsuccessfully to an ITE programme were less effective than certified teachers, leading to 0.17 of a standard deviation lower in maths and 0.13 of a standard deviation lower in language. To tackle the increasing shortages in ITE, and improve selection into teaching, reliable selection methods for ITE programmes could help to identify the best possible

candidates and lead to a better understanding of the factors that influence teacher development (and selection) at the start of their professional careers (Klassen et al., 2020). In particular, Klassen et al. (2020) show that an online test designed to assess non-cognitive attributes of applicants to a ITE programme in the UK was a reliable and valid predictor of performance on the interview day. However, it should be noted that the capacity to adjust selection methods for ITE programmes may vary greatly between European countries (for example, the Irish Central Applications Office (CAO) processes applications centrally for all university undergraduate courses, on the basis of a points system linked to students' performance in high-school leaving exams (MacCoy et al., 2019). As such, a "one size fits all" solution would not be feasible.

While the body of literature investigating ITE (and, similarly, alternative paths into teaching) has grown over the last decade, most research is still correlational in nature – which calls for caution in the interpretation of its findings, as unobserved heterogeneity is likely to play a role (e.g. self-selection bias due to the self-selection of individuals into the teaching profession, or the self-selection of students and teachers into schools).

**In summary, with regard to the debate as to whether to professionalise or deregulate teacher education, the evidence shows that ITE still provides a valuable path into teaching, as ITE-educated teachers exhibit higher retention rates than those who are trained via an alternative route into teaching. Furthermore, the available evidence highlights the value of subject-specific preparation in improving students' test scores in mathematics and science. Given the (little) evidence available, enrolment strategies that envisage the use of promotional campaigns, the offer of scholarships or collaboration between universities and secondary schools have the potential to attract more students to ITE programmes. Lastly, the (limited) evidence points towards the provision of higher levels of support during both the ITE study programme and school placements as an effective way to increase retention in ITE programmes (in line with the findings on the role of induction, support and mentoring in Section 3.5 of this reports).**

### 4.3 Alternative paths into teaching

**Rationale.** Alternative certification or pathways into teaching has been employed increasingly to address teacher shortages and to enhance diversity in the teaching profession by attracting highly qualified graduates and/or professionals from other fields (Eurydice, 2021)<sup>36</sup>. In practice, alternative pathways represent a form of liberalisation of teacher certification, as they make it easier for a wider pool of individuals to enter both teacher preparation and the profession itself, compared with traditional ITE paths. These options differ from regular ITE programmes, minimising entry barriers (in the form of reduced or loosened requirements for teacher certification) and providing avenues into the

---

<sup>36</sup> It should be noted that these solutions are not the same as the short-term use of unqualified teachers, which has been suggested in Austria, the Czech Republic, Estonia, Hungary, Ireland, Malta, the Netherlands, Sweden and Slovakia (Ecorys, 2023). Short-term use of unqualified teachers involves hiring individuals who do not meet the standard qualifications for teaching for a limited period, while alternative certification or pathways into teaching refer to programmes that provide a route for individuals with non-teaching backgrounds to become qualified teachers.

teaching profession to those individuals who favour training ‘on the job’<sup>37</sup>, or who are currently in another profession (See et al., 2020a). Although there is no single model for alternative pathways, two main approaches can be identified: short professional-orientated programmes<sup>38</sup> and employment-based training<sup>39</sup>. While several European education systems (18 out of the 40 that are part of the Eurydice Network) have introduced alternative pathways into the teaching profession, only 4.4 % of teachers have qualified through these alternative routes (TALIS, 2018). The highest shares are observed in Estonia (6.9 %) and the UK (England) (7.9 %) – both countries that offer multiple alternative pathways into the teaching profession.

In order to recruit from outside education, some EU countries have also experimented with various approaches to encourage lateral entry into the teaching profession. For example, in Flanders (Belgium), the expansion of the seniority scheme to include 22 subjects and allow entrants to carry 10 years of seniority (Vlaams Ministerie van Onderwijs en Vorming, 2020) has resulted in increased recruitment: up to 4,400 teachers came from the private sector during the school year 2020-21 (De Morgen, 2022). Germany has increased levels of recruitment through *ad hoc* arrangements for two types of lateral entry, ‘Quereinsteiger’ (career switcher) and ‘Seiteneinsteiger’ (lateral entrant). In the Netherlands, a comprehensive approach has been adopted that includes easing entry requirements, a programme targeting refugees with teaching qualifications, recruitment through collaboration with professional associations, and hybrid programmes tailored for engineers that enable work-study trajectories (see also subsection 4.1.3).

**Evidence.** While alternative pathways into teaching have become more popular, the debate in the literature has focused extensively on the efficacy of such pathways in preparing quality teachers, compared with traditional (ITE) routes (Heilig et al., 2010). In particular, the literature has investigated whether teachers who pursue traditional teaching routes (ITE) and those who follow alternative pathways have differential impacts on students’ test scores (Goldhaber, 2019), finding only minor differences regardless of the level of education (e.g. Constantine et al., 2009; Glazerman, Mayer, & Decker, 2006; Kane, Rockoff, & Staiger, 2008; Xu, Hannaway, & Taylor, 2011). However, there is a much less evidence regarding the effects of offering alternative pathways into teaching on recruitment and retention. With regard to impact on recruitment, Boyd et al. (2012) evaluated the Maths Immersion Program (MIP)<sup>40</sup>, an initiative that reduced entrance requirements into teaching and provided opportunities for qualified individuals interested in mathematics. Using a fixed-effects model, the authors found that the MIP initiative was effective in attracting highly qualified teachers to teach in high-needs schools. In particular, between 2003 and 2008, the number of teachers hired through the MIP increased at a faster pace than those that went through the traditional pathway (ITE) and other

---

<sup>37</sup> Compared with ITE, these programmes usually involve a high degree of flexibility and a shorter duration, while being partly or entirely employment-based (Eurydice, 2021).

<sup>38</sup> In pursuing these programmes, graduates from other fields of higher education follow coursework on pedagogical and psychological disciplines, methodology, didactics and practical training (Eurydice, 2021).

<sup>39</sup> Examples of employment-based training programmes include the ‘Teach First’ and School Centred Initial Teacher Training (SCITT) programmes in the UK, the ‘Minor in education’ programme in the Netherlands, and the ‘Teach for America’ and ‘Teaching Fellows’ programmes in the US (Eurydice, 2021; See et al., 2020a).

<sup>40</sup> The Math Immersion programme, a component of the New York City Teaching Fellows, recruits professionals who have a maths-related undergraduate major (e.g. economics or science), or who have maths-related work experience.

alternative route programmes (that is, the Teaching Fellows (TF) and Teach for America (TFA) programmes<sup>41</sup>). While MIP teachers on average had stronger academic credentials than their ITE-educated peers, they produced relatively smaller gains in maths achievement among middle school maths students than teachers who entered the profession via other pathways. When investigating retention, Boyd et al. (2012) found that immersion teachers were more likely to leave their school than their ITE-educated peers, although less so than TFA<sup>42</sup> teachers. Another study evaluating a 'teaching residency' programme<sup>43</sup> found no significant difference in the retention rates of programme-participant and non-participant teachers within districts (89% and 87% respectively) and within schools (77% and 79%, respectively) (Silva et al., 2015). Using survival analysis, Van Overschelde and Wiggins (2020) found that traditionally trained teachers were significantly more likely to remain in a school than teachers who pursued alternative pathways. Lastly, among the factors associated with higher turnover rates, Carver-Thomas & Darling-Hammond (2019) identified holding an alternative certification. However, another study investigating the effectiveness of TFA teachers in New York City public schools found that the negative impact of higher turnover among TFA teachers is roughly offset by the somewhat higher initial effectiveness of TFA teachers, compared with teachers from traditional pathways (Kane et al., 2008).

**In summary, given the available evidence showing little differential impact on student achievement between ITE-educated and alternative paths teachers, countries with high teacher shortages could make a more extensive use of alternative paths to enlarge their pool of new potential teachers, especially for those teachers in high-need areas, such as STEM fields and special education (Dee & Goldhaber, 2017). However, in view of the higher attrition rates among teachers who have followed an alternative path, an increased offer of alternative pathways should be accompanied by the right mix of incentives for both recruiting and retaining qualified teachers.**

#### **4.4 Use of ICT and computer-assisted learning**

**Rationale.** ICT in general, and computer-assisted learning (CAL) in particular, can potentially mitigate teacher shortages in several ways. First, **they can increase the efficiency of education by providing teachers with access to a wide range of educational resources and tools**, such as online courses, virtual classrooms and educational software. These can help teachers to deliver high-quality lessons more efficiently, as they can use technology to automate tasks such as grading, and to personalise learning for individual students. In addition, CAL can support collaborative learning and provide opportunities for students to work together, even if they are not in the same physical location. Second, **ICT can reduce teachers' workload by automating administrative tasks such as tracking student attendance and**

---

<sup>41</sup> The TF programme subsidises a Master's degree in education for individuals who have already earned a Bachelor's degree, while they work as full-time teachers in high-needs schools. The TFA programme is a national programme that recruits recent college graduates, regardless of their major, and provides them with an intensive summer training programme before placing them in high-needs schools as full-time teachers.

<sup>42</sup> In another study, Darling-Hammond et al. (2005) found rates of attrition among TFA teachers that were around twice as high as those for non-TFA teachers.

<sup>43</sup> Teachers enrolled in this programme follow a course with supervised fieldwork experience teaching in a school for at least a year.

**progress, and managing communication with parents.** This can free up teachers' time to focus on teaching and learning, rather than paperwork and administrative tasks. Third, ICT can support secondary processes such as recruitment, training and professional development. For example, online learning platforms and webinars can provide teachers with access to high-quality training and professional development opportunities (Ansyari, Groot and De Witte, 2022; Compen et al., 2023), regardless of their location or schedule. These can help to address skills gaps and improve the quality of teaching, which can ultimately help to mitigate teacher shortages. Lastly, CAL programmes could prove especially effective in schools facing tight capacity constraints, such as high shortages of qualified teachers or large student-to-teacher ratios (Escueta et al., 2020).

To make maximum use of ICT to mitigate teacher shortages, a few conditions must be met. First, it requires access to adequate hardware and software infrastructure, as well as the systematic use of ICT not only in the classroom but also in the performance of administrative tasks at different levels of the school organisation (to avoid, for example, the duplication of tasks in both paper and digital forms). Second, teachers need to be trained on how to use ICT effectively in the classroom. This includes not only technical training, but also training on how to integrate technology into the curriculum and how to adapt their teaching methods to make use of technology. Third, schools need to choose appropriate technology that is suited to their needs and the needs of their students. Fourth, schools need to provide ongoing technical support for both teachers and students. This includes troubleshooting problems with hardware and software, providing guidance on how to use technology effectively, and ensuring that the technology is working properly. Lastly, ICT needs to be integrated into the curriculum in a meaningful way that enhances student learning. This requires careful planning and coordination between teachers, administrators and technology specialists.

**Evidence.** First, certain considerations can be made regarding adequate access to hardware infrastructure, as well as students' usage. Studies on the availability and use of ICT resources in schools have reported varying degrees of use by teachers, as well as variations in its availability to students across Europe. For example, a European-wide survey found that one in four students in secondary schools have never, or almost never, used a computer at school. When asked the reasons for this, teachers pointed to the insufficient number of devices (e.g. computers, laptops) as the most important obstacle to the use of digital technologies in schools (Ipsos, 2019). While between-country variation exists in the degree of digitalisation<sup>44</sup>, the national recovery plans submitted by EU countries in the aftermath of the COVID-19 pandemic reported a particular emphasis on the digitalisation of the education sector (Zancajo et al., 2022). Although comprehensive updated data on ICT equipment and digitalisation in education across the EU are not yet available (latest available publication: Ipsos, 2019), it is clear that the pandemic has accelerated digitalisation across Europe (Zancajo et al., 2022). In this regard, while the evidence on the provision of laptops in schools consistently report success in terms of increases in the amount of time and/or ease of use<sup>45</sup>, evidence regarding its effects on

---

<sup>44</sup> Southern European countries (Portugal, Italy, Spain, Greece, or Malta) had less digitalised educational systems than, for example, Denmark (Zancajo et al., 2022).

<sup>45</sup> For example, a large-scale randomised experiment in California found that participation in a laptop distribution programme not only increased computer ownership (by 55 percentage points), but also computer use (by 2.5 hours per week) and the likelihood of having internet at home (by 25 percentage points), relative to students who did not receive free laptops (Fairlie & Robinson, 2013).

student achievement is mixed and, in some cases, negative. In particular, findings from two RDD studies – one of subsidised computers for households in Romania (Malamud & Pop-Eleches, 2011) and another that subsidised schools in purchasing computers and software in the Netherlands (Leuven et al. 2007), found negative effects on student achievement. According to these studies, spending more time playing games is to blame for the (albeit minor) negative effects. Meanwhile, the Romanian study also found positive impacts on computer skills and cognitive test scores. These results indicate that close monitoring of the use of ICT is required to ensure it is used in a suitable way to facilitate the learning process of students.

Second, consideration should be given to both the use of software and types of ICT-driven learning programmes. ICT-driven education can support students in the event of teacher shortages by providing an alternative to traditional teaching through access to educational resources in the form of, for example, self-paced learning modules and online<sup>46</sup> lessons. In particular, CAL offers great potential to directly improve the efficiency of investments in skills formation, by mitigating both teacher and classroom constraints (Escueta et al., 2020). CAL has proven useful in solving gaps in staffing in contexts where there is a shortage of qualified teachers, such as in rural areas or developing countries. For example, by means of a randomised experiment in India, Muralidharan et al. (2016) concluded that adaptive CAL catered for a wider spread of students' learning levels than could possibly have been managed by a single teacher, thus opening the way for higher student-to-teacher ratios (for example, when temporarily merging classrooms due to a teacher shortage). One of the main advantages of CAL is its ability to provide personalised learning experiences, learning pathways and feedback that can be tailored to the individual needs and abilities of students (Iterbeke, De Witte & Schelfhout, 2020; Iterbeke, Declercq, De Witte & Schelfhout, 2020). In a randomised experiment, Heppen et al. (2011) compared schools that participated in a full online algebra course with control schools that instead followed the regular maths curriculum (which did not include the full algebra course). This situation can be considered close to that of a teacher shortage, under which students without a teacher would probably miss part of the curriculum. Thanks to the online material, they can gain access to content that they would otherwise have not been able to access. Heppen et al. (2011) found that taking the online algebra course significantly improved students' achievement. Notwithstanding the promising positive results, the external validity of this study is unknown.

Furthermore, **while CAL can be a useful tool for supporting student learning in the absence of direct instruction from a teacher, it should only be used as a short-term solution to teacher shortages.** Teachers play a crucial role in supporting students' emotional and social development, and in providing guidance and support, which cannot be replaced by CAL. For example, the effects of blended learning are generally on a par with those of fully in-person courses, indicating how a combination of direct instruction from a teacher and online learning may be more cost effective than ICT-driven solutions alone (Escueta et al., 2020).

---

<sup>46</sup> The increasing offer of online education have been explained by its ability to improve access to wider audiences and to reduce the marginal costs associated with teaching more students (Escueta et al., 2020). As online teaching has many elements (as well as strengths and weaknesses) in common with CAL, the discussion here refers solely to CAL. For an extensive review of the causal literature on online education, see Escueta et al. (2020).

**In summary, given the available evidence, the most promising policy models to mitigate teacher shortages through the use of CAL may be those that combine hardware distribution (e.g. the provision of laptops in schools) with particular learning programmes, such as subject-specific courses that provide tailored feedback and personalised learning experiences.**

## Chapter 5. Key policy implications and recommendations

This report presents the rationale and evidence for different policy measures aimed at mitigating teacher shortages in Europe. Because the needs of schools can vary by region and by school type, there is no 'silver bullet' nor 'one size fits all' solution to teacher shortages. Nevertheless, the interventions discussed can serve as a starting point for dealing with teacher shortages more effectively, while avoiding jeopardising educational quality and inequality – and, where possible, potentially improving them.

In this final chapter, we review the report's main findings and provide a brief overview of the effectiveness of the suggested policy interventions in tackling teacher shortages, as well as their associated costs, potential side effects and requirements for success. These are presented in summary tables for each level of intervention (i.e. teacher-level, school-level and system-level). The second column of each table presents a categorisation of policy measures according to their potential to address teacher shortages. The evidence base for each policy measure is evaluated and classified into one of four levels: none, low, medium, and high. These levels take into account both the number of studies assessing each measure, and their quality (including, for example, the extent to which their design allows causal inference<sup>47</sup>, and the representativeness and size of the sample). For instance, a large number of attitudinal surveys and cross-country correlation studies suggest that salary increases will help tackle to teacher shortages. However, the precise relationship is only explored by a handful of quasi-experimental studies. We therefore rate the evidence base for this as medium. In the third column of each table, the effectiveness of each intervention is summarised using the same four categories. The fourth column also uses these categories to distinguish the financial costs of the different policy measures. These ratings refer to our own 'expert judgement' based on the available evidence, as the evidence base was mostly too limited to rigorously quantify effectiveness and costs.<sup>48</sup> Where we find both positive and negative effects, the effectiveness of a measure is rated as 'mixed'. 'Unclear' is used where the evidence base is too small to draw any conclusion with respect to either financial costs or effectiveness. The final column discusses potential side effects of the measure, aside from tackling teacher shortages. Such side effects include educational quality. The column also lists any conditions for the intervention's success. It is crucial to consider potential side effects, as each reform requires the consideration of a broad perspective as to its potential consequences. The conditions for success specify what specific insights should be taken into account in developing a policy measure to maximise its potential effectiveness, based on the available evidence. Where relevant, the evidence base for both potential side effects and conditions for success is specified in a similar manner to the evidence base on the effectiveness of the policy measures.

---

<sup>47</sup> Randomised controlled trials are the gold standard for assessing quality. Linear regressions, with or without control variables, do not allow us to draw any strong conclusions on the causality of a relationship. Depending on the quality of their design, quasi-experimental studies, such as regression discontinuity design or difference-in-differences, allow causal interpretation. These studies can be regarded as falling in-between randomised controlled trials and correlational evidence with respect to their ability to make causal inferences (European Commission, 2022).

<sup>48</sup> For example, the outcome variables used to measure the effects of different policy measures are inconsistent between studies. Some measure attrition, some retention, and some turnover. Some focus on the short term, others on medium-term outcomes. Lastly, there is inconsistency in the relative 'size' of the policy measures considered, such as how large the financial incentives were. The financial costs of different policy measures are also highly variable, based on local conditions and specific implementation.

Overall, the report also makes clear that we lack evidence regarding some of the less obvious and potentially interesting solutions to teacher shortages, such as promoting hybrid teachers, facilitating task differentiation or introducing a multi-level career structure. More research on the effectiveness of these measures is needed. In line with the recommendation of the European Commission report "Investing in our future: Quality investment in education and training" (2022), we suggest experimenting in small-scale RCTs, before implementing on a larger scale. Lastly, throughout the report, we focus on compulsory education, but do not distinguish between education levels unless specifically stated in the reviewed literature. This choice allows us to provide a more comprehensive review of interventions that can be applied across different education levels, and adapted to various contexts.

### 5.1 Teacher-level interventions

Chapter 2 of this report focuses on interventions **at teacher level**. It discusses policy measures aimed at enhancing the conditions of teachers, including options such as augmenting teachers' remuneration or alleviating their workload. In addition, the chapter examines various alternatives such as granting teachers greater autonomy and heightening their social status through promotional campaigns. Table 1 summarises the available evidence at teacher level. Based on this, several policy conclusions can be drawn.

Overall, the table reveals that for a few interventions, there is a strong evidence base pointing to a high level of effectiveness. For the majority of the interventions, however, the evidence base is judged to be low-to-medium, while their expected effectiveness is similarly low-to-medium. Focusing on the most promising interventions (i.e. those with at least a medium evidence base and medium effectiveness), four recommendations can be made with regard to teacher-level interventions.

First, we recommend the use of **targeted financial incentives**, as these are promising with respect to cost-effectiveness – especially in promoting the retention of teachers in areas of high need. These incentives include bonuses, salary differentials and deferred retirement plans. Evidence from a policy intervention in Oslo, Norway, shows that a wage premium of around 10% granted to retain teachers in high-vacancy schools (which, in turn, was lost once the teachers moved to a low-vacancy school) reduces the probability of teachers voluntarily quitting by around 6 percentage points. In addition, financial incentives can be an effective tool to promote the retention of teachers in disadvantaged schools, and consequently to foster the equity of education. We rate financial incentives for teachers in disadvantaged schools and hard-to-staff subjects as highly effective, at a medium cost, based on a high evidence base. We argue that financial incentives for retired teachers or career-switchers are potentially less cost-effective, with only a medium evidence base. At the same time, it should be kept in mind that the effectiveness of financial incentives cannot be translated one-to-one between Member States as, for example, labour markets differ from each other, which means that the effects of wage incentives may vary between countries (Stolp, et al., 2023).

Second, based on the available evidence and literature, we recommend closing the salary gap between teachers and similarly educated workers. An **across-the-board salary increase** can be an effective policy measure in tackling teacher shortages by improving

both the attractiveness of the profession and the retention of in-service teachers. However, while we rate 'closing the salary gap with similarly tertiary-educated workers' as highly effective, this measure comes with very high costs, based on a medium evidence base. Across-the-board salary increases do offer the potential positive side effects of increasing diversity in the teaching profession with respect to gender and ethnicity, as well as attracting more high-quality teachers by enhancing the profession's status. However, the evidence on these potential positive side effects is low.

Third, we recommend focusing on combined interventions such as **an across-the-board salary increase that is compensated for by a proportional increase in class sizes**. The available evidence suggests that this would be cost-effective in raising the attractiveness of the teaching profession, and would also be budget-neutral. While this policy has the potential side effect of worse learning gains due to larger classes, the higher salary might attract higher-quality teachers (which is a more important input into educational quality than class sizes). We rate this policy measure as having medium to low effectiveness with no costs, based on a medium to low evidence base.

Lastly, we recommend exploring the use of teaching assistants to reduce teachers' workload. Teaching assistants can carry out some tasks at a similar level of quality to teachers, but at a lower cost. One particularly promising avenue for reducing teachers' workload while increasing educational quality is the provision of small-scale tutoring by less qualified teaching personnel.

*Table 1. Overview of policy measures to tackle teacher shortages at teacher level, together with evidence base, effectiveness, costs and potential side-effects and conditions for success*

<b>Policy measure</b>	<b>Evidence base</b>	<b>Effectiveness</b>	<b>Financial costs</b>	<b>Potential side effects and conditions for success</b>
Closing the salary gap with similarly tertiary-educated workers	Medium Suggestive evidence from attitudinal surveys and some quasi-experimental evidence	High	Very high	Increase in teacher quality (low evidence) Increase in teacher diversity with respect to gender and ethnicity (low evidence)
Financial incentives for teachers in disadvantaged schools	High Quasi-experimental evidence	High	Medium	Decreased motivation of other teachers (low evidence) Include a tie-in clause, or differentially high salaries for extended periods (not just one-year signing bonuses) to incentivise longer stays (low evidence)

<b>Policy measure</b>	<b>Evidence base</b>	<b>Effectiveness</b>	<b>Financial costs</b>	<b>Potential side effects and conditions for success</b>
Financial incentives for teachers in hard-to-staff subjects	High  Quasi-experimental evidence and 'back-of-an-envelope' cost-benefit analysis	High	Medium	Decreased motivation of other teachers (low evidence)  Include a tie-in clause to incentivise longer stays (low evidence)
Financial incentives for retired (or close to retirement) teachers	Medium  Structural estimates from a dynamic retirement model	Medium/High  Effect tends to be short-term	Medium/High	
Financial incentives for career-switchers	Medium  Descriptive and correlational evidence	Medium  Succeeds in attracting new teachers but dropout rates are higher than US national average	Medium	Include a tie-in clause, or differentially high salaries for extended periods (not just one-year signing bonuses) to incentivise longer stays (low evidence)
Performance-based salary	Medium  Experimental and quasi-experimental evidence	Low/Medium	Medium	Increase in teacher motivation (low evidence)  Can cause 'teaching-to-the-test' (medium evidence)
Restructuring compensation – flatter pay scales	Low  Some discrete choice experiments	Unclear	None	Less experienced teachers (low evidence)
Restructuring compensation – shifting compensation from retirement benefits to salary	Low  Some discrete choice experiments	Unclear	None	Less experienced teachers (low evidence)
Reducing class sizes	Medium  Suggestive evidence from attitudinal surveys, some discrete choice experiments, but no policy evaluations	Medium/Low	High	Improved learning outcomes due to smaller classes (medium/large evidence base)

<b>Policy measure</b>	<b>Evidence base</b>	<b>Effectiveness</b>	<b>Financial costs</b>	<b>Potential side effects and conditions for success</b>
Increasing class sizes with proportional increase compensation	Medium/Low  Some discrete choice experiments, no policy evaluations	Medium/Low	None	Improved learning outcomes due to higher quality teachers (low evidence)  Worsened learning outcomes due to larger classes (medium/large evidence base)  Political feasibility needs to be assessed
Reducing amount of statutory teaching hours	Low  Suggestive evidence from attitudinal surveys, one discrete choice experiment, but no policy evaluations.	Medium	High	
Increasing role of teaching assistants to lower workload	Medium/low  Some discrete choice experiments, no policy evaluations.	Medium	Medium	
Increasing teachers' autonomy over the curriculum	Low  Suggestive evidence from attitudinal surveys and a discrete choice experiment	Low	None	Impedes other policies such as performance-based pay and standardised curricula
Promotion campaign to address behavioural barriers and improve teacher status	Medium  A lot of experimental research, but usually in different settings.	Mixed	Low	Increase in teacher quality due to higher status (low evidence)

## 5.2. School-level interventions

Chapter 3 highlights those interventions that can be implemented **at school level**. The chapter underscores the importance of supporting and valuing teachers as professionals to address teacher shortages. It argues that well-governed schools attract and retain quality teachers, who feel valued and supported by the school community. Using similar classifications to those in Table 1, **Error! Reference source not found.** summarises the available evidence, effectiveness and financial costs at school level. Overall, we observe that most interventions have only a low evidence base and a low expected impact on attracting and retaining teachers. Focusing on interventions with at least a medium evidence base and medium effectiveness, we make two recommendations.

First, it is recommended to **implement longer induction and mentoring programmes (of at least two years)**. Induction programmes for new teachers lead to higher teacher retention rates, faster professional development, and enhanced student learning outcomes. Mentorship programmes that offer same-subject mentors, as well as regular collaboration and external networking, are the most successful measures. Furthermore, providing mentor training and allowing partial release from regular duties can improve the teaching practice of new teachers by providing personalised coaching and support.

Second, the chapter also suggests that **stimulating continuous professional development** could be an effective way to increase teacher retention. Professional development activities should have a high content focus, involve active learning, have a sustained duration, provide collective participation, offer coherence and ownership. In addition, while the research remains limited, teacher collaboration, e.g. in professional learning communities, could result in the increased retention of teachers.

*Table 2. Overview of policy measures to tackle teacher shortages at school level, together with evidence base, effectiveness, costs, and potential side-effects and conditions for success*

<b>Policy measure</b>	<b>Evidence base</b>	<b>Effectiveness</b>	<b>Financial costs</b>	<b>Potential side effects and conditions for success</b>
Centralised vs. decentralised teacher allocation	Low Some correlation cross-country	Mixed	Unclear	
Giving schools autonomy over salary setting	Medium Quasi-experimental evidence and some correlation cross-country comparisons. Theoretical arguments	Low	None	Allows schools to differentiate salary between teachers, based on performance (low evidence) or subject  Only desirable if schools have autonomy over hiring decisions and if disadvantaged schools don't have lower spending power than advantaged schools

<b>Policy measure</b>	<b>Evidence base</b>	<b>Effectiveness</b>	<b>Financial costs</b>	<b>Potential side effects and conditions for success</b>
Update human resources practices	Low Some fixed-effects models	Low Evidence on the timing of hiring	Unclear	Teachers hired after the start of the school year are less efficient and more likely to exit the profession (medium evidence)
Increasing compensation for principals	Low Strong evidence on the importance of principals, but unclear whether higher compensation would improve the quality or retention of principals	Low	Low	Might enhance educational quality if it improves the quality of principals (low evidence)
Implementing longer induction and mentoring programmes	Medium Correlational evidence and a cost-benefit analysis. Theoretical arguments	Medium/high	Medium	Programmes should last at least 2 years (low evidence)
Stimulating continuous professional development	Medium Experimental and correlational evidence	Medium	Medium	Subject-based CPD, and CPD involving active learning, of sustained duration, providing collective participation, offering coherence and ownership, might be more effective (low evidence)
Promoting the use of professional learning communities	Low Mixed-methods and correlational evidence	Low	Low	
Promoting co-teaching with increased class sizes	Low A discrete choice experiment, and correlational evidence. Theoretical arguments	Low	Low	If classes become too large, there is a risk of lower retention rates among co-teaching teachers (low-to-medium evidence)

### 5.3. System-level interventions

Chapter 4 focuses on **system-level interventions** to mitigate teacher shortages. Using a similar classification to that in Table 1, Table 3 summarises the available evidence at system level. Focusing on interventions with at least a medium evidence base and medium effectiveness, three policy conclusions can be drawn.

First, it is recommended to promote existing initial teacher education (ITE) programmes. **While the quality of ITE programmes** contribute to the attractiveness of the teaching profession, ITE still provides a valuable path into teaching. Therefore, in the debate about whether to professionalise or deregulate teacher education, countries should carefully consider the evidence and retention rates among ITE-educated teachers versus those trained via an alternative route into teaching.

Second, countries facing teacher shortages could utilise **alternative pathways** to attract potential teachers, especially in high-need areas, as there is little difference in student achievement between traditionally and alternatively trained teachers. However, teachers trained in alternative pathways are more likely to leave their schools than traditionally trained teachers. Therefore, to combat the higher attrition rates of alternative-path teachers, recruiting and retaining incentives must be balanced.

Third, it is recommended to improve the **use of computer-assisted learning (CAL)** in education. Under the conditions of adequate hardware and software, teacher professional development, ongoing technical support and integrating into the curriculum, its use can increase the efficiency of education by providing teachers with access to a wide range of educational resources and tools, and can reduce teachers' workload by automating administrative tasks. Although CAL can be beneficial in supporting student learning in situations where direct teacher instruction is unavailable, it should only be used as a temporary solution to address teacher shortages. This is because teachers have a critical role to play in promoting students' social and emotional development, as well as providing guidance and support, which cannot be substituted by CAL.

*Table 3. Overview of policy measures to tackle teacher shortages at system level, together with evidence base, effectiveness, costs, and potential side-effects and conditions for success.*

<b>Policy measure</b>	<b>Evidence base</b>	<b>Effectiveness</b>	<b>Financial costs</b>	<b>Potential side-effects and conditions for success</b>
Introducing multi-level career structure	Low  Evidence from attitudinal surveys and discrete choice experiment	Low/medium	Low/medium	Might attract more men and high-quality teachers, who place more importance on status (low evidence)
Facilitating task differentiation	None  Theoretical arguments	Low	Low	

<b>Policy measure</b>	<b>Evidence base</b>	<b>Effectiveness</b>	<b>Financial costs</b>	<b>Potential side-effects and conditions for success</b>
Facilitating teacher mobility between subjects and education levels	Low  One attitudinal survey and some theoretical arguments	Unclear	Medium  If achieved through reform of ITE and more time for professional development  High  If remuneration is also equalised across levels of education	Might improve educational quality (low evidence)
Promoting existing initial teacher education programmes	Medium  Correlational evidence and one experiment	Medium	Low	Improve student achievement when subject-specific (maths and science) (low/medium evidence)
Increasing offer of alternative pathways into teaching	High  Policy evaluations, survival analysis and correlational analysis	Medium  Higher attrition rates among teachers who have followed an alternative path	Unclear	Combine with mix of incentives / other measures targeted at retaining teachers (low evidence)
Increasing the use of computer-assisted learning	High  Experimental and quasi-experimental evidence.	Medium/High  Short-term solution	Low/Medium  Depending on current presence of hardware	In combination with hardware distribution (low/medium evidence)

## References

- Abadie, A., & Cattaneo, M. D. (2018). Econometric methods for program evaluation. *Annual Review of Economics*, 10(1), 465–503.
- Ajzenman, N., Bertoni, E., Elacqua, G., Marotta, L., & Méndez Vargas, C. (2020). Altruism or money? Reducing teacher sorting using behavioral strategies in Peru. *Working paper*.
- Ajzenman, N., Elacqua, G., Hincapié, D., Jaimovich, A., Boo, F. L., Paredes, D., & Román, A. (2021). Career choice motivation using behavioral strategies. *Economics of Education Review*, 84, 102173.
- Allegretto, S., Corcoran, S., & Mishel, L. (2008). The Teaching Penalty: Teacher Pay Losing Ground. Economic Policy Institute.
- Allen, R., & Sims, S. (2017). Improving Science Teacher Retention: do National STEM Learning Network professional development courses keep science teachers in the classroom. Welcome Trust: London, UK.
- Ansyari, M. F., Groot, W., & De Witte, K. (2020). Tracking the process of data use professional development interventions for instructional improvement: A systematic literature review. *Educational Research Review*, 31, 100362.
- Ansyari, M. F., Groot, W., & De Witte, K. (2022). Teachers' preferences for online professional development: Evidence from a discrete choice experiment. *Teaching and Teacher Education*, 119, 103870.
- Atteberry, A., Loeb, S., & Wyckoff, J. (2015). Do first impressions matter? Predicting early career teacher effectiveness. *AERA Open*, 1(4), 2332858415607834.
- Aubusson, P. J., Watson, K., Vozzo, L., & Steele, F. A. (2004). Retraining teachers to teach science: is it good?. *Teaching Science*.
- Baeten, M., & Simons, M. (2014). Student teachers' team teaching: Models, effects, and conditions for implementation. *Teaching and Teacher Education*, 41, 92–110.
- Ballou, D., & Podgursky, M. (1998). Teacher recruitment and retention in public and private schools. *Journal of Policy Analysis and Management*, 17(3), 393–417.
- Basit, T. N., Roberts, L., McNamara, O., Carrington, B., Maguire, M., & Woodrow, D. (2006). Did they jump or were they pushed? Reasons why minority ethnic trainees withdraw from initial teacher training courses. *British Educational Research Journal*, 32(3), 387–410.
- Bates, M. (2020). Public and private employer learning: Evidence from the adoption of teacher value added. *Journal of Labor Economics*, 38(2), 375–420.
- Becker, B., & Gerhart, B. (1996). The impact of human resource management on organizational performance: Progress and prospects. *Academy of Management Journal*, 39(4), 779–801.
- Berlinski, S., & Ramos, A. (2020). Teacher mobility and merit pay: Evidence from a voluntary public award program. *Journal of Public Economics*, 186, 104186.
- Bertron, C., Vélou, A. E., Buisson-Fenet, H., & Dumay, X. (2023). The Dualisation of Teacher Labour Markets, Employment Trajectories and the State in France. *Work, Employment and Society*, 09500170221128681.
- Biasi, B. (2021). The labor market for teachers under different pay schemes. *American Economic Journal: Economic Policy*, 13(3), 63–102.
- Borman, G. D., & Dowling, N. M. (2008). Teacher attrition and retention: A meta-analytic and narrative review of the research. *Review of Educational Research*, 78(3), 367–409.
- Borman, G. D., & Dowling, N. M. (2008). Teacher attrition and retention: A meta-analytic and narrative review of the research. *Review of Educational Research*, 78(3), 367–409.

- Bouck, E. C. (2007). Co-teaching... not just a textbook term: Implications for practice. *Preventing School Failure: Alternative Education for Children and Youth*, 51(2), 46-51.
- Boyd, D., Grossman, P., Hammerness, K., Lankford, H., Loeb, S., Ronfeldt, M., & Wyckoff, J. (2012). Recruiting effective math teachers: Evidence from New York city. *American Educational Research Journal*, 49(6), 1008-1047.
- Boyd, D., Grossman, P., Ing, M., Lankford, H., Loeb, S., & Wyckoff, J. (2011). The influence of school administrators on teacher retention decisions. *American Educational Research Journal*, 48(2), 303-333.
- Bradbury, A., Tereshchenko, A., & Mills, M. (2022). Minoritised teachers' experiences of multiple, intersectional racisms in the school system in England: 'carrying the weight of racism'. *Race, Ethnicity and Education*, 1-17.
- Bray, M. (2021). Shadow education in Europe: Growing prevalence, underlying forces, and policy implications. *ECNU Review of Education*, 4(3), 442-475.
- Bryan, C. J., Tipton, E., & Yeager, D. S. (2021). Behavioural science is unlikely to change the world without a heterogeneity revolution. *Nature Human Behaviour*, 5(8), 980-989.
- Bryant, J., Ram, S., Scott, D., & Williams, C. (2023). K-12 teachers are quitting. What would make them stay?. McKinsey & Company.
- Brown, K. M. (2013). The link between pensions and retirement timing: Lessons from California teachers. *Journal of Public Economics*, 98, 1-14.
- Burgess, S., Greaves, E., & Murphy, R. (2022). Deregulating Teacher Labor Markets. *Economics of Education Review*, 88, 102253.
- Burke, P. F., Aubusson, P. J., Schuck, S. R., Buchanan, J. D., & Prescott, A. E. (2015). How do early career teachers value different types of support? A scale-adjusted latent class choice model. *Teaching and Teacher Education*, 47, 241-253.
- Campbell, C., Osmond-Johnson, P., Faubert, B., Zeichner, K., Hobbs-Johnson, A., Brown, S., DaCosta, P., Hales, A., Kuehn, L., Sohn, J., & Stevensen, K. (2017), "The state of educators' professional learning in Canada: final research report", Learning Forward, Oxford, OH.
- Cantrell, S., Fullerton, J., Kane, T. J., & Staiger, D. O. (2008). National board certification and teacher effectiveness: Evidence from a random assignment experiment (No. w14608). National Bureau of Economic Research.
- Carlo, A., Michel, A., Chabanne, J. C., Bucheton, D., Demougin, P., Gordon, J., ... & Valette, S. (2013). Study on policy measures to improve the attractiveness of the teaching profession in Europe. European Commission, Directorate General For Education and Training.
- Carothers, D., Aydin, H., & Houdyshell, M. (2019). Teacher shortages and cultural mismatch: District and university collaboration for recruiting. *Journal of Social Studies Education Research*, 10(3), 39-63.
- Carrizosa, L., & De Witte, K. (2023). Teacher absenteeism: a conceptual model developed from a systematic literature review. KU Leuven working paper series.
- Carver-Thomas, D., & Darling-Hammond, L. (2019). The trouble with teacher turnover: How teacher attrition affects students and schools. *Education Policy Analysis Archives*, 27(36).
- Cavalluzzo, L., Barrow, L., & Henderson, S. (2014). From Large Urban to Small Rural Schools: An Empirical Study of National Board Certification and Teaching Effectiveness. Final Report. CNA Corporation.
- Chamberlin, R., Wragg, T., Haynes, G., & Wragg, C. (2002). Performance-related pay and the teaching profession: A review of the literature. *Research Papers in Education*, 17(1), 31-49.

- Chang, L.-C., & Lee, G. C. (2010). A team-teaching model for practicing project-based learning in high school: Collaboration between computer and subject teachers. *Computers & Education*, 55(3), 961–969.
- Chen, B., Dougherty, S., Goldhaber, D., Holden, K., & Theobald, R. (2022). CTE teacher licensure and long-term student outcomes. *Education Finance and Policy*, 1-24.
- Chetty, R., Friedman, J. N., & Rockoff, J. E. (2014). Measuring the impacts of teachers II: Teacher value-added and student outcomes in adulthood. *American Economic Review*, 104(9), 2633-2679.
- Childs, R., Broad, K., Gallagher-Mackay, K., Sher, Y., Escayg, K, & C. McGrath, C. (2011). *The Teachers Ontario Needs: Pursuing Equity in Teacher Education Program Admissions*. Toronto: Ontario Institute for Studies in Education.
- Chingos, M. M. (2011). *The False Promise of Class-Size Reduction*. Center for American Progress.
- Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2007). Teacher credentials and student achievement: Longitudinal analysis with student fixed effects. *Economics of Education Review*, 26(6), 673-682.
- Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2010). Teacher credentials and student achievement in high school a cross-subject analysis with student fixed effects. *Journal of Human Resources*, 45(3), 655-681.
- Clotfelter, Glennie, E., Ladd, H., & Vigdor, J. (2008). Would higher salaries keep teachers in high-poverty schools? Evidence from a policy intervention in North Carolina. *Journal of Public Economics*, 92(5), 1352–1370.
- Clotfelter, Ladd, H. F., & Vigdor, J. L. (2011). Teacher Mobility, School Segregation, and Pay-Based Policies to Level the Playing Field. *Education Finance and Policy*, 6, 399–438.
- Coenen, J., Cornelisz, I., Groot, W., Maassen van den Brink, H., & Van Klaveren, C. (2018). Teacher characteristics and their effects on student test scores: A systematic review. *Journal of Economic Surveys*, 32(3), 848-877.
- Coffman, L. C., Featherstone, C. R., & Kessler, J. B. (2017). Can social information affect what job you choose and keep?. *American Economic Journal: Applied Economics*, 9(1), 96-117.
- Coldwell, M. (2017). Exploring the influence of professional development on teacher careers: A path model approach. *Teaching and Teacher Education*, 61, 189-198.
- Compen, B., De Witte, K., & Schelfhout, W. (2019). The role of teacher professional development in financial literacy education: A systematic literature review. *Educational Research Review*, 26, 16-31.
- Compen, B., De Witte, K., & Schelfhout, W. (2021). The impact of teacher engagement in an interactive webinar series on the effectiveness of financial literacy education. *British Journal of Educational Technology*, 52(1), 411-425.
- Compen, B., De Witte, K., Declercq, K., & Schelfhout, W. (2023). Improving students' financial literacy by training teachers using an online professional development module. *Education Economics*, 31(1), 77-101.
- Connelly, V., & Graham, S. (2009). Student teaching and teacher attrition in special education. *Teacher Education and Special Education*, 32(3), 257-269.
- Constantine, J., Player, D., Silva, T., Hallgren, K., Grider, M., & Deke, J. (2009). *An Evaluation of Teachers Trained through Different Routes to Certification*. Final Report. NCEE 2009-4043. National Center for Education Evaluation and Regional Assistance.
- Contini, D., Di Tommaso, M. L., & Mendolia, S. (2017). The gender gap in mathematics achievement: Evidence from Italian data. *Economics of Education Review*, 58, 32-42.

- Cortes, P., & Pan, J. (2018). Occupation and gender. *The Oxford handbook of women and the economy*, 425-452.
- Costrell, Robert, and Joshua McGee. 2010. Teacher pension incentives, retirement behavior, and potential for reform in Arkansas. *Education Finance and Policy*, 5(4): 492–518.
- Craig, C. J. (2016). Structure of Teacher Education. In J. Loughran & M. L. Hamilton (Eds.), *International Handbook of Teacher Education: Volume 1* (pp. 69–135). Springer. [https://doi.org/10.1007/978-981-10-0366-0\\_3](https://doi.org/10.1007/978-981-10-0366-0_3)
- D’Inverno, G., Smet, M., & De Witte, K. (2021). Impact evaluation in a multi-input multi-output setting: Evidence on the effect of additional resources for schools. *European Journal of Operational Research*, 290(3), 1111-1124.
- Daly, W. M., & Carnwell, R. (2003). Nursing roles and levels of practice: a framework for differentiating between elementary, specialist and advancing nursing practice. *Journal of Clinical Nursing*, 12(2), 158-167.
- Damore, S. J., & Murray, C. (2009). Urban elementary school teachers' perspectives regarding collaborative teaching practices. *Remedial and Special Education*, 30(4), 234-244.
- Dang, H. A., & Rogers, F. H. (2008). The growing phenomenon of private tutoring: Does it deepen human capital, widen inequalities, or waste resources?. *The World Bank Research Observer*, 23(2), 161-200.
- Darling-Hammond, L. (2006). Securing the right to learn: Policy and practice for powerful teaching and learning. *Educational Researcher*, 35(7), 13-24.
- Darling-Hammond, L., Chung, R., & Frelow, F. (2002). Variation in Teacher Preparation: How Well Do Different Pathways Prepare Teachers to Teach? *Journal of Teacher Education*, 53(4), 286–302.
- Darling-Hammond, L., Holtzman, D. J., Gatlin, S. J., & Heilig, J. V. (2005). Does teacher preparation matter? Evidence about teacher certification, Teach for America, and teacher effectiveness. *Education Policy Analysis Archives/Archivos Analíticos de Políticas Educativas*, 13, 1-48.
- Darling-Hammond, L., Hylar, M. E., & Gardner, M. (2017). Effective teacher professional development. Available online: [https://www.yu.edu/sites/default/files/inline-files/Effective\\_Teacher\\_Professional\\_Development\\_REPORT.pdf](https://www.yu.edu/sites/default/files/inline-files/Effective_Teacher_Professional_Development_REPORT.pdf) (accessed on 21 March 2023).
- De Cort, W. & De Witte, K. (2023b). Private supplementary education and the welfare loss of supply shortages in higher education. Manuscript in preparation.
- De Cort, W. & De Witte, K. (2023b). To teach or not to teach? Job attributes, information and the supply of teachers. Manuscript in preparation.
- De Morgen. (2022). Bijna 4.400 Vlamingen maakten overstap van privé naar het onderwijs (Nearly 4,400 Flemings switched from the private sector to education). <https://www.demorgen.be/snelnieuws/bijna-4-400-vlamingen-maakten-overstap-van-prive-naar-het-onderwijs~bdd81973/?referrer=https%3A%2F%2Fwww.google.com%2F>
- De Witte, K. & Iterbeke, K. (2022). Het lerarentekort als katalysator voor onderwijshervormingen.. *Leuvense Economische Standpunten*, 191, p. 16.
- De Witte, K. (2022). Les in hetzelfde schoolgebouw als je betovergrootouders (On the relationship between school infrastructure, school finances and education outcomes). *Leuvense Economische Standpunten*, 2022/196, p. 9.
- De Witte, K. and François, M. (2023). Covid-19 learning deficits in Europe: analysis and practical recommendations. EENEE Analytical report for European Commission. ISBN 978-92-76-55798-2, pp. 66.
- DeAngelis, K., Wall, A., & Che, J. (2013). The Impact of Preservice Preparation and Early Career Support on Novice Teachers’ Career Intentions and Decisions.

- <https://urresearch.rochester.edu/institutionalPublicationPublicView.action?institutionalItemVersionId=27274>
- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227-268.
- Dee, T. S. (2004). Teachers, race, and student achievement in a randomized experiment. *Review of Economics and Statistics, 86*(1), 195-210.
- Dee, T. S. (2007). Teachers and the gender gaps in student achievement. *Journal of Human Resources, 42*(3), 528-554.
- Dee, T. S., & Cohodes, S. R. (2008). Out-of-field teachers and student achievement: Evidence from matched-pairs comparisons. *Public Finance Review, 36*(1), 7-32.
- Dee, T. S., & Goldhaber, D. (2017). Understanding and addressing teacher shortages in the United States. *The Hamilton Project, 5*, 1-28.
- Delhomme, S. (2022). High school role models and minority college achievement. *Economics of Education Review, 87*, 102222.
- den Brok, P., Wubbels, T., & Van Tartwijk, J. (2017). Exploring beginning teachers' attrition in the Netherlands. *Teachers and Teaching, 23*(8), 881-895.
- Dieterle, S. G. (2015). Class-size reduction policies and the quality of entering teachers. *Labour Economics, 36*, 35-47.
- Dixon, F. A., Yssel, N., McConnell, J. M., & Hardin, T. (2014). Differentiated instruction, professional development, and teacher efficacy. *Journal for the Education of the Gifted, 37*(2), 111-127. <https://doi.org/10.1177/0162353214529042>
- Dolton, P., & Marcenaro-Gutierrez, O. D. (2011). If you pay peanuts do you get monkeys? A cross-country analysis of teacher pay and pupil performance. *Economic Policy, 26*(65), 5-55.
- Dolton, P., Marcenaro, O., Vries, R. D., & She, P. W. (2018). Global teacher status index 2018. Varkey Foundation.
- Dorenbosch, L., van der Velden, K., Bilkes, M. (2018). De hybride docent: een aantrekkelijk loopbaanperspectief in het vo? Onderwijs aan het werk.
- Duflo, E., Hanna, R., & Ryan, S. P. (2012). Incentives work: Getting teachers to come to school. *American Economic Review, 102*(4), 1241-1278.
- DuFour, R. (2004). What is a "professional learning community"? *Educational Leadership, 61*(8), 6-11.
- Ecorys. (2016). Study on the diversity within the teaching profession with particular focus on migrant and minority background. Brussels, Belgium: European Commission.
- Ecorys. (Forthcoming). Summary report: Teacher Shortages in the EU Member States.
- Education and Training Monitor (2022). Country report Hungary. Brussels.
- Elacqua, G., Hincapie, D., Hincapié, I., & Montalva, V. (2022). Can Financial Incentives Help Disadvantaged Schools to Attract and Retain High-Performing Teachers? Evidence from Chile. *Journal of Policy Analysis and Management, 41*(2), 603-631.
- Engel, M. (2012). The Timing of Teacher Hires and Teacher Qualifications: Is There an Association? *Teachers College Record, 114*(12), 1-29. <https://doi.org/10.1177/016146811211401205>
- Ersoy, F., & Speer, J. (2022, October). Opening the Black Box of College Major Choice: Evidence from an Information Intervention. In 2022 APPAM Fall Research Conference. APPAM.
- Escueta, M., Nickow, A. J., Oreopoulos, P., & Quan, V. (2020). Upgrading Education with Technology: Insights from Experimental Research. *Journal of Economic Literature, 58*(4), 897-996.
- European Commission (2017). Teachers and school leaders in schools as learning organisations. Guiding principles for policy development in school education. European Commission, Directorate-General Education, Youth, Sport and Culture.

- European Commission (2022), *Investing in our future: Quality investment in education and training*. ISBN: 978-92-76-57410-1.
- European Parliament (2020). *Teaching careers in the EU - Why boys do not want to be teachers*. February 2020.
- Eurydice. (2018). *Teaching careers in Europe: Access, Progression and Support*. Eurydice Report. Luxembourg: Publications Office of the European Union.
- Eurydice. (2021). *Teachers in Europe Careers, Development and Well-being*. Eurydice Report. Luxembourg: Publications Office of the European Union.
- Eurydice. (2022a). *Teachers' and School Heads' Salaries and Allowances in Europe—2020/2021* (Eurydice Facts and Figures). <https://eurydice.eacea.ec.europa.eu/publications/teachers-and-school-heads-salaries-and-allowances-europe-20202021>
- Eurydice. (2022b). *Increasing achievement and motivation in mathematics and science learning in schools*. Eurydice report. Luxembourg: Publications Office of the European Union.
- Ewing, R., & Smith, D. (2003). Retaining quality beginning teachers in the profession. *English Teaching: Practice and Critique*, 2(1), 15-32.
- Fairlie, R. W., & Robinson, J. (2013). Experimental evidence on the effects of home computers on academic achievement among schoolchildren. *American Economic Journal: Applied Economics*, 5(3), 211-240.
- Falch, T. (2010). The elasticity of labor supply at the establishment level. *Journal of Labor Economics*, 28(2), 237-266.
- Falch, T. (2011). Teacher mobility responses to wage changes: Evidence from a quasi-natural experiment. *American Economic Review*, 101(3), 460-465.
- Farrell, P., Alborz, A., Howes, A., & Pearson, D. (2010). The impact of teaching assistants on improving pupils' academic achievement in mainstream schools: A review of the literature. *Educational Review*, 62(4), 435-448.
- Feiman-Nemser, S. (2012), *Beyond solo teaching*. *Educational Leadership*, Vol. 69 No. 8, pp. 10-16.
- Feld, J., Salamanca, N., & Zölitz, U. (2020). Are professors worth it? The value-added and costs of tutorial instructors. *Journal of Human Resources*, 55(3), 836-863.
- Feng, L., & Sass, T. R. (2018). The Impact of Incentives to Recruit and Retain Teachers in "Hard-to-Staff" Subjects. *Journal of Policy Analysis and Management*, 37(1), 112-135. <https://doi.org/10.1002/pam.22037>
- Fitzpatrick, Maria, and Michael Lovenheim. 2014. Early retirement incentives and student achievement. *American Economic Journal: Economic Policy*, 6(3): 120-154
- Flanigan, R. L. (2016). January 27. More Districts Mine Data to Refine Hiring.. *Education Week*, 35(19), S3.
- Fowler, R. (2003). The Massachusetts signing bonus program for new teachers: A model of teacher preparation worth? *Education Analysis Archives*, 11(13), 1-24.
- Fray, L., & Gore, J. (2018). Why people choose teaching: A scoping review of empirical studies, 2007-2016. *Teaching and Teacher Education*, 75, 153-163.
- Friedrich, A., Flunger, B., Nagengast, B., Jonkmann, K., & Trautwein, U. (2015). Pygmalion effects in the classroom: Teacher expectancy effects on students' math achievement. *Contemporary Educational Psychology*, 41, 1-12.
- Friend, M. (2015). Co-teaching versus apprentice teaching: An analysis of similarities and differences. *Teacher Education and Special Education*, 38(2), 79-87.
- Fryer, R. G. (2013). Teacher incentives and student achievement: Evidence from New York City public schools. *Journal of Labor Economics*, 31(2), 373-407.

- Fuchsman, D., McGee, J. B., & Zamarro, G. (2023). Teachers' willingness to pay for retirement benefits: A national stated preferences experiment. *Economics of Education Review*, 92, 102349.
- Gambi, L., & De Witte, K. (2023). The uphill battle: The amplifying effects of negative trends in test scores, COVID-19 school closures and teacher shortages. *FEB Research Report Department of Economics*.
- Gately, S., & Gately, F. (2001). Understanding coteaching components. *Teaching Exceptional Children*, 33(5), 40-47.
- Gershenson, S., Hart, C. M., Hyman, J., Lindsay, C., & Papageorge, N. W. (2018). The long-run impacts of same-race teachers (No. w25254). National Bureau of Economic Research.
- Gilraine, M., & Pope, N. G. (2021). *Making teaching last: Long-run value-added* (No. w29555). National Bureau of Economic Research.
- Gjefsen, H. M. (2020). Wages, teacher recruitment, and student achievement. *Labour Economics*, 65, 101848.
- Glazerman, S., & Seifullah, A. (2012). An evaluation of the Chicago Teacher Advancement Program (Chicago TAP) after four years (Final Rep.). Mathematica Policy Research
- Glazerman, S., Isenberg, E., Dolfin, S., Bleeker, M., Johnson, A., Grider, M., & Jacobus, M. (2010). Impacts of Comprehensive Teacher Induction: Final Results from a Randomized Controlled Study. NCEE 2010-4027. National Center for Education Evaluation and Regional Assistance.
- Glazerman, S., Mayer, D., & Decker, P. (2006). Alternative routes to teaching: The impacts of Teach for America on student achievement and other outcomes. *Journal of Policy Analysis and Management: The Journal of the Association for Public Policy Analysis and Management*, 25(1), 75-96.
- Goddard, Y. L., Goddard, R. D., & Tschannen-Moran, M. (2007). A theoretical and empirical investigation of teacher collaboration for school improvement and student achievement in public elementary schools. *Teachers College Record*, 109(4), 877-896.
- Goldhaber, D. D., & Brewer, D. J. (1996). Evaluating the effect of teacher degree level on educational performance.
- Goldhaber, D. D., & Brewer, D. J. (1997). Why don't schools and teachers seem to matter? Assessing the impact of unobservables on educational productivity. *Journal of Human Resources*, 505-523.
- Goldhaber, D. D., & Brewer, D. J. (2000). Does teacher certification matter? High school teacher certification status and student achievement. *Educational Evaluation and Policy Analysis*, 22(2), 129-145.
- Goldhaber, D., & Anthony, E. (2007). Can teacher quality be effectively assessed? National board certification as a signal of effective teaching. *Review of Economics and Statistics*, 89(1), 134-150.
- Goldhaber, D., Krieg, J., & Theobald, R. (2020). Effective like me? Does having a more productive mentor improve the productivity of mentees?. *Labour Economics*, 63, 101792.
- Gottfried, M., Kirksey, J. J., & Fletcher, T. L. (2022). Do high school students with a same-race teacher attend class more often?. *Educational Evaluation and Policy Analysis*, 44(1), 149-169.
- Gray, L., & Taie, S. (2015). Public School Teacher Attrition and Mobility in the First Five Years: Results from the First through Fifth Waves of the 2007-08 Beginning Teacher Longitudinal Study. First Look. NCEES 2015-337. In National Center for Education Statistics. National Center for Education Statistics. <https://eric.ed.gov/?id=ED556348>
- Grenda, J. P., & Hackmann, D. G. (2014). Advantages and challenges of distributing leadership in middle-level schools. *NASSP Bulletin*, 98(1), 53-74.

- Grissom, J. A., & Strunk, K. O. (2012). How should school districts shape teacher salary schedules? Linking school performance to pay structure in traditional compensation schemes. *Educational Policy*, 26(5), 663-695.
- Guarino, C. M., Santibanez, L., & Daley, G. A. (2006). Teacher recruitment and retention: A review of the recent empirical literature. *Review of Educational Research*, 76(2), 173-208.
- Guryan, J., Ludwig, J., Bhatt, M. P., Cook, P. J., Davis, J. M., Dodge, K., ... & Stoddard, G. (2023). Not too late: Improving academic outcomes among adolescents. *American Economic Review*, 113(3), 738-765.
- Hanushek, E. A. & Rivkin, S. G. (2007). Pay, working conditions and teacher quality. *The Future of Children*, 17(1), 69-86.
- Hanushek, E. A., & Rivkin, S. G. (2006). Teacher quality. *Handbook of the Economics of Education*, 2, 1051-1078.
- Haque, Z., & Elliot, S. (2017). Visible and invisible barriers: The impact of racism on BME teachers. London: National Union of Teachers, available online: <https://www.teachers.org.uk/sites/default/files2014/barriersreport.pdf> (accessed on 28 March 2023).
- Harackiewicz, J. M., Rozek, C. S., Hulleman, C. S., & Hyde, J. S. (2012). Helping parents to motivate adolescents in mathematics and science: An experimental test of a utility-value intervention. *Psychological Science*, 23(8), 899-906.
- Harris, D. N., & Sass, T. R. (2011). Teacher training, teacher quality and student achievement. *Journal of Public Economics*, 95(7-8), 798-812.
- Harrison, J., Dymoke, S., & Pell, T. (2006). Mentoring beginning teachers in secondary schools: An analysis of practice. *Teaching and Teacher Education*, 22(8), 1055-1067.
- Heckman, J. J., & Krueger, A. B. (2005). Inequality in America: What role for human capital policies?. *MIT Press Books*, 1.
- Heinz, M., Keane, E., & Davison, K. (2023). Gender in initial teacher education: entry patterns, intersectionality and a dialectic rationale for diverse masculinities in schooling. *European Journal of Teacher Education*, 46(1), 134-153.
- Helms-Lorenz, M., Slof, B., & van de Grift, W. (2013). First year effects of induction arrangements on beginning teachers' psychological processes. *European Journal of Psychology of Education*, 28(4), 1265-1287.
- Hendricks, M. D. (2014). Does it pay to pay teachers more? Evidence from Texas. *Journal of Public Economics*, 109(C), 50-63.
- Heppen, J. B., Walters, K., Clements, M., Faria, A. M., Tobey, C., Sorensen, N., & Culp, K. (2011). Access to Algebra I: The Effects of Online Mathematics for Grade 8 Students. NCEE 2012-4021. National Center for Education Evaluation and Regional Assistance.
- Hill, A. J., & Jones, D. B. (2020). The Impacts of Performance Pay on Teacher Effectiveness and Retention Does Teacher Gender Matter?. *Journal of Human Resources*, 55(1), 349-385.
- Hobson, A. J., Giannakaki, M. S., & Chambers, G. N. (2009b). Who withdraws from initial teacher preparation programmes and why?. *Educational Research*, 51(3), 321-340.
- Hobson, A. J., & Maxwell, B. (2017), "Supporting and inhibiting the well-being of early career secondary school teachers: extending self-determination theory", *British Educational Research Journal*, Vol. 43 No. 1, pp. 168-191.
- Hobson, A. J., Ashby, P., Malderez, A., & Tomlinson, P. D. (2009a). "Mentoring beginning teachers: what we know and what we don't". *Teaching and Teacher Education*, Vol. 25 No. 1, pp. 207-216.
- Holmlund, H., & Sund, K. (2008). Is the gender gap in school performance affected by the sex of the teacher?. *Labour Economics*, 15(1), 37-53.

- Hord, S. M. (1997). Professional learning communities: Communities of continuous inquiry and improvement.
- Hosek, J., Knapp, D., Mattock, M. G., & Asch, B. J. (2023). Incentivizing retirement: An analysis of cash retirement incentives for Chicago teachers. *Educational Researcher*, 52(2), 71-79.
- Humphrey, N., Hennessey, A., Ashworth, E., Frearson, K., Black, L., Petersen, K., Wo, L., Panayiotou, M., Lendrum, A., Wigelsworth, M., Birchinnall, L., Squires, G., & Pampaka, M. (2018). Good Behaviour Game: Evaluation Report and Executive Summary. Education Endowment Foundation.
- Ingersoll, & Strong, M. (2011). The Impact of Induction and Mentoring Programs for Beginning Teachers: A Critical Review of the Research. *Review of Educational Research*, 81(2), 201–233. <https://doi.org/10.3102/0034654311403323>
- Ingersoll, R. M., May, H., & Collins, G. (2019). Recruitment, employment, retention and the minority teacher shortage. *Education Policy Analysis Archives*, 27(37).
- Ingersoll, R., Merrill, L., & May, H. (2014). What Are the Effects of Teacher Education and Preparation on Beginning Teacher Attrition? CPRE Research Reports. <https://doi.org/10.12698/cpre.2014.rr82>
- Ipsos, M. O. R. I. (2019). 2nd survey of schools: ICT in education: objective 1: benchmark progress in ICT in schools, final report.
- Iterbeke, K., De Witte, K., & Schelfhout, W. (2020). The effects of computer-assisted adaptive instruction and elaborated feedback on learning outcomes. A randomized control trial. *Computers in Human Behavior* 120, 106666.
- Iterbeke, K., De Witte, K., Declercq, K. & Schelfhout, W. (2020). The Effect of Group Formation and Differentiated Instruction in Financial Literacy Education. Evidence from Two Randomised Control Trials. *Economics of Education Review*, 78, 101949.
- Jacob, R., Goddard, R., Kim, M., Miller, R., & Goddard, Y. (2015). Exploring the causal impact of the McREL Balanced Leadership Program on leadership, principal efficacy, instructional climate, educator turnover, and student achievement. *Educational Evaluation and Policy Analysis*, 37(3), 314-332.
- Jamal, M., Baba, V. V., & Riviere, R. (1998). Job stress and well-being of moonlighters: the perspective of deprivation or aspiration revisited. *Stress Medicine*, 14(3), 195-202.
- Jang, S.-J. (2008). Innovations in science teacher education: Effects of integrating technology and team-teaching strategies. *Computers & Education*, 51(2), 646–659.
- Johnson, S. M. (2007). Finders and keepers: Helping new teachers survive and thrive in our schools. Indianapolis, IN: Jossey-Bass.
- Jones, M., & Hartney, M. T. (2017). Show who the money? Teacher sorting patterns and performance pay across U.S. school districts. *Public Administration Review*, 77(6), 919–931.
- Jones, N. D., Maier, A., & Grogan, E. (2011). The Extent of Late-Hiring and Its Relationship with Teacher Turnover: Evidence from Michigan. Society for Research on Educational Effectiveness.
- Kahneman, D. (1979). Prospect theory: An analysis of decisions under risk. *Econometrica*, 47, 278.
- Kane, T. J., Rockoff, J. E., & Staiger, D. O. (2008). What does certification tell us about teacher effectiveness? Evidence from New York City. *Economics of Education Review*, 27(6), 615-631.
- Katsarova, I. (2020). Teaching careers in the EU. Why boys do not want to be teachers. *European Parliament. PE 642.220 – February 2020*.
- Keane, E., Heinz, M., & Lynch, A. (2022). Factors impacting on the retention of students from under-represented groups in initial teacher education in Ireland. *Tertiary Education and Management*, 1-19.

- Kengatharan, N. (2020). The effects of teacher autonomy, student behavior and student engagement on teacher job satisfaction. *Educational Sciences: Theory & Practice*, 20(4), 1-15.
- Kim, D., Koedel, C., Kong, W., Ni, S., Podgursky, M., & Wu, W. (2021). Pensions and late-career teacher retention. *Education Finance and Policy*, 16, no. 1 (2021): 42-65.
- Kim, D. (2023). The effect of 31st year pension enhancement on mid- and late-career retirement decisions. *Applied Economics Letters*, 30(2), 229-238.
- Kimbrel, L. (2019). Teacher hiring: The disconnect between research based best practice and processes used by school principals. *Administrative Issues Journal: Connecting Education, Practice, and Research*, 9(2), 12-27.
- King-Sears, M. E., Stefanidis, A., Berkeley, S., & Strogilos, V. (2021). Does co-teaching improve academic achievement for students with disabilities? A meta-analysis. *Educational Research Review*, 34, 100405. <https://doi.org/10.1016/j.edurev.2021.100405>
- Klassen, R. M., Kim, L. E., Rushby, J. V., & Bardach, L. (2020). Can we improve how we screen applicants for initial teacher education?. *Teaching and Teacher Education*, 87, 102949.
- Knudsen, C. W. (1938). Ways to improve the professional status of teachers. *Peabody Journal of Education*, 16(2), 91-97.
- Koch, T., Gerber, C., & De Klerk, J. J. (2018). The impact of social media on recruitment: Are you LinkedIn?. *SA Journal of Human Resource Management*, 16(1), 1-14.
- Koedel, C., & Xiang, P. B. (2017). Pension Enhancements and the Retention of Public Employees. *ILR Review*, 70(2), 519-551.
- Konoske-Graf, A., Partelow, L., & Benner, M. (2016). To attract great teachers, school districts must improve their human capital systems. Center for American Progress, 1-30.
- Kraft, M. A., List, J. A., Livingston, J. A., & Sadoff, S. (2022). Online tutoring by college volunteers: Experimental evidence from a pilot program. In *AEA Papers and Proceedings* (Vol. 112, pp. 614-618). American Economic Association.
- Kruse, S. D., & Louis, K. S. (1993). An emerging framework for analyzing school-based professional community.
- Kutsyruba, B., Godden, L., & Bosica, J. (2019). The impact of mentoring on the Canadian early career teachers' well-being. *International Journal of Mentoring and Coaching in Education*, 8(4), 285-309.
- Kyriacou, C., & Coulthard, M. (2000). Undergraduates' views of teaching as a career choice. *Journal of education for Teaching*, 26(2), 117-126.
- Kyriacou, C., Kunc, R., Stephens, P., & HULTGREN, A. G. (2003). Student teachers' expectations of teaching as a career in England and Norway. *Educational Review*, 55(3), 255-263.
- Lachlan, L., Kimmel, L., Mizrav, E., & Holdheide, L. (2020). Advancing Quality Teaching for All Schools: Examining the Impact of COVID-19 on the Teaching Workforce. Center on Great Teachers and Leaders.
- Lankford, H., & Wyckoff, J. (1997). The changing structure of teacher compensation, 1970-1994. *Economics of Education Review*, 16(4), 371-384.
- Lazear, E. P., & Shaw, K. L. (2007). Personnel economics: The economist's view of human resources. *Journal of Economic Perspectives*, 21(4), 91-114. <https://doi.org/10.1257/jep.21.4.91>
- Leuven, E., Lindahl, M., Oosterbeek, H., & Webbink, D. (2007). The effect of extra funding for disadvantaged pupils on achievement. *Review of Economics and Statistics*, 89(4), 721-736.
- Leuven, E., & Oosterbeek; H. (2018). Class size and student outcomes in Europe. EENEE Analytical Report No. 33.
- Lewis, C. W., & Toldson, I. A. (2013). Black male teachers: Diversifying the United States' teacher workforce. In *Black male teachers* (Vol. 1, pp. xiii-xv), Emerald Group Publishing Limited.

- Li, H. H. (2018). Do mentoring, information, and nudge reduce the gender gap in economics majors?. *Economics of Education Review*, 64, 165-183.
- Lin, P. Y., Childs, R. A., & Zhang, J. (2016). It takes a toll on pre-service teachers and programs: Case studies of teacher candidates who withdrew from a teacher education program. *Cogent Education*, 3(1), 1160524.
- Lindsay, C. A., & Hart, C. M. (2017). Exposure to same-race teachers and student disciplinary outcomes for Black students in North Carolina. *Educational Evaluation and Policy Analysis*, 39(3), 485-510.
- Liou, P. Y., Kirchhoff, A., & Lawrenz, F. (2010). Perceived effects of scholarships on STEM majors' commitment to teaching in high need schools. *Journal of Science Teacher Education*, 21(4), 451-470.
- Liu, E., & Johnson, S. M. (2006). New Teachers' Experiences of Hiring: Late, Rushed, and Information-Poor. *Educational Administration Quarterly*, 42(3), 324-360.
- Loeb, S., & Myung, J. (2020). Chapter 29—Economic approaches to teacher recruitment and retention. In S. Bradley & C. Green (Eds.), *The Economics of Education (Second Edition)* (pp. 403-414). Academic Press.
- Loeb, S., & Page, M. E. (2000). Examining the link between teacher wages and student outcomes: The importance of alternative labor market opportunities and non-pecuniary variation. *Review of Economics and Statistics*, 82(3), 393-408.
- Loeb, S., Miller, L. C., & Wyckoff, J. (2015). Performance screens for school improvement: The case of teacher tenure reform in New York City. *Educational Researcher*, 44(4), 199-212.
- Löfström, E. & Eisenschmidt, E. (2009). Novice teachers' perspectives on mentoring: The case of the Estonian induction year. *Teaching and Teacher Education*, 25(5), 681-689.
- Louis, K. S., Marks, H. M., & Kruse, S. (1996). Teachers' professional community in restructuring schools. *American Educational Research Journal*, 33(4), 757-798.
- MacCoy, S., Byrne, D., O'Sullivan, J., & Smyth, E. (2019). The early impact of the revised Leaving Certificate grading scheme on student perceptions and behaviour (No. 85). Research Series.
- Madia, S. A. (2011). Best practices for using social media as a recruitment strategy. *Strategic HR Review*.
- Malamud, O., & Pop-Eleches, C. (2011). Home computer use and the development of human capital. *The Quarterly Journal of Economics*, 126(2), 987-1027.
- Maldonado, J., & De Witte, K. (2022). The effect of school closures on standardised student test outcomes. *British Educational Research Journal*, 48 (1), p. 49-94.
- Maldonado, J., De Witte, K., & Declercq, K. (2022). The Effects of Parental Involvement in Homework – Two Randomised Controlled Trials in Financial Education. *Empirical Economics*, 62, 1439-1646.
- Manthei, R., Gilmore, A., Tuck, B., & Adair, V. (1996). Teacher stress in intermediate schools. *Educational Research*, 38(1), 3-19.
- Maynes, N., & Hatt, B. E. (2011). Grounding program change in students' learning: A model for the conceptual shift in thinking that will support valuable program change in response to faculty of education reviews. *The question of evidence in research in teacher education in the context of teacher education program review in Canada*, 2. Winnipeg: University of Manitoba, Faculty of Education.
- Miller, A. (2013). Principal turnover and student achievement. *Economics of Education Review*, 36, 60-72.
- Ministerie van Onderwijs, Cultuur en Wetenschap. (2021). Staatscourant 2021, 44436. Regeling van de Minister voor Basis- en Voortgezet Onderwijs en Media van 14 oktober 2021, nr. PO/FenV/29524765 tot het verstrekken van bijzondere en aanvullende bekostiging voor het

- primair en voortgezet onderwijs voor de uitvoering van een arbeidsmarkttoelage binnen het Nationaal Programma Onderwijs voor het schooljaar 2021–2022 (Regulation of the Minister for Primary and Secondary Education and the Media of 14 October 2021, no. PO/FenV/29524765 to provide special and supplementary funding for primary and secondary education for the implementation of a labor market allowance within the National Education Program for the 2021–2022 school year). <https://zoek.officielebekendmakingen.nl/stcrt-2021-44436.html#>
- Ministerie van Onderwijs, Cultuur en Wetenschap. (2022). Staatscourant 2022, 17722. Regeling van de Minister voor Primair en Voortgezet Onderwijs van 28 juni 2022, nr. VO/FenV/32663449 tot het verstrekken van aanvullende bekostiging voor het primair en voortgezet onderwijs voor de uitvoering van een arbeidsmarkttoelage binnen het Nationaal Programma Onderwijs voor het schooljaar 2022-2023 (Regulation of the Minister for Primary and Secondary Education of 28 June 2022, no. VO/FenV/32663449 to provide additional funding for primary and secondary education for the implementation of a labor market allowance within the National Education Program for the 2022-2023 school year). <https://zoek.officielebekendmakingen.nl/stcrt-2022-17722.html>
- Monard, G. (2009). *Kwaliteit en kansen voor elke leerling. Een visie op de vernieuwing van het secundair onderwijs*. Flemish Department of Education.
- Moore, D. A. (2017). How to improve the accuracy and reduce the cost of personnel selection. *California Management Review*, 60(1), 8-17.
- Munn, Z., Peters, M. D., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology*, 18, 1-7.
- Muralidharan, K., Singh, A., & Ganimian, A. J. (2019). Disrupting education? Experimental evidence on technology-aided instruction in India. *American Economic Review*, 109(4), 1426-1460.
- Murawski, W. W., & Swanson, H. L. (2001). A meta-analysis of co-teaching research. *Remedial & Special Education*, 22(5), 258–268.
- Musset, P. (2010). Initial teacher education and continuing training policies in a comparative perspective: Current practices in OECD countries and a literature review on potential effects.
- Niederle, M., & Vesterlund, L. (2007). Do women shy away from competition? Do men compete too much?. *The Quarterly Journal of Economics*, 122(3), 1067-1101.
- OECD. (2005). *Teachers Matter*. Paris: OECD Publishing.
- OECD. (2010). *Learning for Jobs*. Paris: OECD Publishing.
- OECD. (2015). *The ABC of gender equality in education: aptitude, behaviour, confidence*, PISA.
- OECD. (2016). *Education at a Glance 2016: OECD Indicators*. Organisation for Economic Co-operation and Development. [https://www.oecd-ilibrary.org/education/education-at-a-glance-2016\\_eag-2016-en](https://www.oecd-ilibrary.org/education/education-at-a-glance-2016_eag-2016-en)
- OECD. (2018). *Effective Teacher Policies: Insights from PISA*, PISA, Paris: OECD Publishing, <https://doi.org/10.1787/9789264301603-en>.
- OECD. (2019a). *TALIS 2018 Results (Volume I): Teachers and School Leaders as Valued Professionals*, TALIS, Paris: OECD Publishing, <https://doi.org/10.1787/1d0bc92a-en>.
- OECD. (2019b). *TALIS 2018 Results (Volume II): Teachers and School Leaders as Lifelong Learners*, TALIS, Paris: OECD Publishing, <https://doi.org/10.1787/1d0bc92a-en>.
- OECD. (2022a). *Mending the Education Divide: Getting Strong Teachers to the Schools That Need Them Most*, TALIS, Paris: OECD Publishing, <https://doi.org/10.1787/92b75874-en>.
- OECD. (2022b). *Education at a Glance 2022: OECD Indicators*, Paris: OECD Publishing, <https://doi.org/10.1787/3197152b-en>.
- Olebe, M. (2001). A Decade of Policy Support for California’s New Teachers: The Beginning Teacher Support and Assessment Program. *Teacher Education Quarterly*, 28(1), 71–84.

- Onderwijsraad. (2018). Ruim baan voor leraren. Een nieuw perspectief op het leraarschap. Den Haag: Onderwijsraad.
- Oreopoulos, P. (2021). Nudging and Shoving Students toward Success: What the research shows about the promise and limitations of behavioral science in education. *Education Next*, 21(2), 8-16.
- Ouazad, A. (2014). Assessed by a teacher like me: Race and teacher assessments. *Education Finance and Policy*, 9(3), 334-372.
- Papay, J. P., & Kraft, M. A. (2016). The Productivity Costs of Inefficient Hiring Practices: Evidence From Late Teacher Hiring. *Journal of Policy Analysis and Management*, 35(4), 791-817.
- Paredes, V. (2014). A teacher like me or a student like me? Role model versus teacher bias effect. *Economics of Education Review*, 39, 38-49.
- Pérez-Díaz, V., & Rodríguez, J. C. (2014). Teachers' Prestige in Spain: probing the public's and the teachers' contrary views. *European Journal of Education*, 49(3), 365-377.
- Pham, L. D., Nguyen, T. D., & Springer, M. G. (2021). Teacher merit pay: A meta-analysis. *American Educational Research Journal*, 58(3), 527-566.
- Pizarro, M., & Kohli, R. (2020). "I stopped sleeping": Teachers of color and the impact of racial battle fatigue. *Urban Education*, 55(7), 967-991.
- Poekert, P. E. (2012). Teacher leadership and professional development: Examining links between two concepts central to school improvement. *Professional Development in Education*, 38(2), 169-188.
- Pont, B., Moorman, H., & Nusche, D. (2008). Improving school leadership (Vol. 1, p. 578). Paris: OECD.
- Prenger, R., Poortman, C. L., & Handelzalts, A. (2019). The effects of networked professional learning communities. *Journal of Teacher Education*, 70(5), 441-452.
- Quiocho, A. & Rios, F. (2000). The power of their presence: Minority group teachers and schooling.
- Raue, K., & Gray, L. (2015). Career Paths of Beginning Public School Teachers: Results from the First through Fifth Waves of the 2007-08 Beginning Teacher Longitudinal Study. Stats in Brief. NCES 2015-196. National Center for Education Statistics.
- Raymond, M., Fletcher, S., & Luque, J. (2001). An evaluation of teacher differences and student outcomes in Houston, Texas. CREDO, Hoover Institution, Stanford University.
- Redding, C., & Smith, T. M. (2016). Easy in, easy out: Are alternatively certified teachers turning over at increased rates?. *American Educational Research Journal*, 53(4), 1086-1125.
- Reynolds, C. (Ed.). (2002). *Women and school leadership: International perspectives*. SUNY Press.
- Rosenthal, R., & Jacobson, L. (1968). Pygmalion in the classroom. *Urban Review*, 3, 16-20.
- Rowan, B., Chiang, F. S., & Miller, R. J. (1997). Using research on employees' performance to study the effects of teachers on students' achievement. *Sociology of Education*, 256-284.
- Saks, K., Soosaar, R., & Ilves, H. (2016). The students' perceptions and attitudes to teaching profession, the case of Estonia. 7th International Conference on Education and Educational Psychology, Rhodes, Greece.
- Sandmeier, A., Baeriswyl, S., Krause, A., & Muehlhausen, J. (2022). Work until you drop: Effects of work overload, prolonging working hours, and autonomy need satisfaction on exhaustion in teachers. *Teaching and Teacher Education*, 118, 103843.
- Sandmeier, A., Baeriswyl, S., Krause, A., & Muehlhausen, J. (2022). Work until you drop: Effects of work overload, prolonging working hours, and autonomy need satisfaction on exhaustion in teachers. *Teaching and Teacher Education*, 118, 103843.
- Santiago, P. (2002). Teacher Demand and Supply: Improving Teaching Quality and Addressing Teacher Shortages. *OECD Education Working Papers*, No. 1, Paris: OECD Publishing,

- Sappa, V., Boldrini, E., & Aprea, C. (2015). Combining teaching with another job: a possible resource to face professional challenges. Preliminary findings from a Swiss study in vocational education and training. *Empirical Research in Vocational Education and Training*, 7, 1-23.
- See, B. H., Morris, R., Gorard, S., & El Soufi, N. (2020b). What works in attracting and retaining teachers in challenging schools and areas?. *Oxford Review of Education*, 46(6), 678-697.
- See, B. H., Morris, R., Gorard, S., Kokotsaki, D., & Abdi, S. (2020a). Teacher recruitment and retention: A critical review of international evidence of most promising interventions. *Education Sciences*, 10(10), 262.
- See, B. H., Morris, R., Gorard, S., Kokotsaki, D., & Abdi, S. (2020). Teacher recruitment and retention: A critical review of international evidence of most promising interventions. *Education Sciences*, 10(10), 262.
- Shanks, R. (2017), "Mentoring beginning teachers: professional learning for mentees and mentors", *International Journal of Mentoring and Coaching in Education*, Vol. 6 No. 3, pp. 158-163.
- Skelton, C. (2002). The 'feminisation of schooling' or 're-masculinising' primary education?. *International Studies in Sociology of Education*, 12(1), 77-96.
- Smith, T. M., & Ingersoll, R. M. (2004). What Are the Effects of Induction and Mentoring on Beginning Teacher Turnover? *American Educational Research Journal*, 41(3), 681-714. <https://doi.org/10.3102/00028312041003681>
- Snodgrass Rangel, V. (2018). A review of the literature on principal turnover. *Review of Educational Research*, 88(1), 87-124.
- Springer, M. G., Lewis, J. L., Podgursky, M. J., Ehlert, M. W., Taylor, L. L., Lopez, O. S., & Peng, A. (2009). Governor's Educator Excellence Grant (GEEG) Program: Year Three evaluation report. National Center on Performance Incentives.
- Springer, M. G., Swain, W. A., & Rodriguez, L. A. (2016). Effective teacher retention bonuses: Evidence from Tennessee. *Educational Evaluation and Policy Analysis*, 38(2), 199-221.
- Statistics UK (2023). Initial Teacher Training Census. Academic year 2022/23.
- Stolp, T., Somers, M., Fleck, L., Groot, W., & van Merode, F. (2023). De effectiviteit van financiële prikkels om lerarentekorten aan te pakken. Een systematisch literatuuroverzicht (The effectiveness of financial incentives to address teacher shortages. A systematic literature review). *Over.werkK*, 37.
- Struyven, K., Jacobs, K., & Dochy, F. (2013). Why do they want to teach? The multiple reasons of different groups of students for undertaking teacher education. *European Journal of Psychology of Education*, 28, 1007-1022.
- Tang, C. J., Chan, S. W., Zhou, W. T., & Liaw, S. Y. (2013). Collaboration between hospital physicians and nurses: an integrated literature review. *International Nursing Review*, 60(3), 291-302.
- Teachers' Union of Ireland (2022). Survey among 100 principals and deputies.
- Tenenbaum, H. R., & Ruck, M. D. (2007). Are teachers' expectations different for racial minority than for European American students? A meta-analysis. *Journal of Educational Psychology*, 99(2), 253-273.
- Thomas, L., Tuytens, M., Devos, G., Kelchtermans, G., & Vanderlinde, R. (2020). Transformational school leadership as a key factor for teachers' job attitudes during their first year in the profession. *Educational Management Administration & Leadership*, 48(1), 106-132.
- Thompson, G., Hogan, A., & Stacey, M. (2023). Getting inside the 'heavy hours': Understanding why teachers' work has become so demanding. *Australian Educator*, 118, 22-24.
- Thomson, M. M., Turner, J. E., & Nietfeld, J. L. (2012). A typological approach to investigate the teaching career decision: Motivations and beliefs about teaching of prospective teacher candidates. *Teaching and Teacher Education*, 28(3), 324-335.

- Tichy, N. M., Fombrun, C. J., & Devanna, M. A. (1982). Strategic human resource management. *Sloan Management Review*, 23(2), 47. Retrieved from: <https://www.proquest.com/scholarly-journals/strategic-human-resource-management/docview/224968461/se-2>
- Tran, H. (2017). The impact of pay satisfaction and school achievement on high school principals' turnover intentions. *Educational Management Administration & Leadership*, 45(4), 621-638.
- Tuytens, M., Vekeman, E., & Devos, G. (2023). A focus on students' and teachers' learning through strategic human resource management. *School Effectiveness and School Improvement*, 1-24.
- UNESCO (2019). *Teacher Policy Development Guide*. Paris.
- UNESCO Statistics (2020). "Education – Human Resources – Teachers – Percentage of Female Teachers by Teaching Level of Education – 2018 Figures." Available at: <http://data.uis.unesco.org>
- van Hek, M., Buchmann, C., & Kraaykamp, G. (2019). Educational systems and gender differences in reading: A comparative multilevel analysis. *European Sociological Review*, 35(2), 169-186.
- Van Laar, E., Van Deursen, A. J., Van Dijk, J. A., & De Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, 72, 577-588.
- Van Overschelde, J. P., & Wiggins, A. Y. (2020). Teacher preparation pathways: Differences in program selection and teacher retention. *Action in Teacher Education*, 42(4), 311-327.
- Vescio, V., Ross, D., & Adams, A. (2008). A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and Teacher Education*, 24(1), 80-91.
- Veteska, J., Kursch, M., Svobodova, Z., Tureckiova, M., & Paulovcakova, L. (2022). Longitudinal Co-teaching Projects: Scoping Review. *Orchestration of Learning Environments in the Digital World*, 35-53.
- Villar, A., & Strong, M. (2007). Is mentoring worth the money? A benefit-cost analysis and five-year rate of return of a comprehensive mentoring program for beginning teachers. *ERS Spectrum*, Summer, 25.
- Villegas, A. M., & Irvine, J. J. (2010). Diversifying the teaching force: An examination of major arguments. *Urban Review*, 42(3), 175-192.
- Vlaams Ministerie van Onderwijs en Vorming. (2020). Circular PERS/2020/04 of 15/07/2020. Geldelijke validering van ervaring als werknemer of zelfstandige voor knelpuntambten en -vakken voor zijinstromers (Financial validation of experience as an employee or self-employed person for bottleneck positions and subjects for lateral entrants). <https://data-onderwijs.vlaanderen.be/edulex/document/15714>
- Wang, J., Odell, S. J., & Schwille, S. A. (2008). Effects of teacher induction on beginning teachers' teaching: A critical review of the literature. *Journal of Teacher Education*, 59(2), 132-152. <https://doi.org/10.1177/0022487107314002>
- Weingarten, R. (2019a, February 27). AFT President Randi Weingarten on Federal Legislation to Reduce Class Sizes [Press Release]. <https://www.aft.org/press-release/aft-president-randi-weingarten-federal-legislation-reduce-class-sizes>
- Wexler, E. (2016). To connect with candidates, school recruiters hone social media skills. *Education Week*.
- Wilensky, H. L. (1963). The moonlighter: A product of relative deprivation. *Industrial Relations: A Journal of Economy and Society*, 3(1), 105-124.
- Willén, A. (2021). Decentralization of wage determination: Evidence from a national teacher reform. *Journal of Public Economics*, 198, 104388.

- Winters, M. A., Haight, R. C., Swaim, T. T., & Pickering, K. A. (2013). The effect of same-gender teacher assignment on student achievement in the elementary and secondary grades: Evidence from panel data. *Economics of Education Review*, 34, 69-75.
- Wiswall, M., & Zafar, B. (2015). Determinants of college major choice: Identification using an information experiment. *Review of Economic Studies*, 82(2), 791-824.
- Worth, J., & Van den Brande, J. (2020). Teacher Autonomy: How Does It Relate to Job Satisfaction and Retention?. *National Foundation for Educational Research*.
- Wright, A., Gottfried, M. A., & Le, V. N. (2017). A kindergarten teacher like me: The role of student-teacher race in social-emotional development. *American Educational Research Journal*, 54(1\_suppl), 78S-101S.
- Wynn, S. R., Carboni, L. W., & Patall, E. A. (2007). Beginning teachers' perceptions of mentoring, climate, and leadership: Promoting retention through a learning communities perspective. *Leadership and Policy in Schools*, 6(3), 209-229.
- Xu, Z., Hannaway, J., & Taylor, C. (2011). Making a difference? The effects of Teach for America in high school. *Journal of Policy Analysis and Management*, 30(3), 447-469.
- Yoo, H., & Jang, J. (2022). Effects of professional learning communities on teacher collaboration, feedback provision, job satisfaction and self-efficacy: Evidence from Korean PISA 2018 data. *Compare: A Journal of Comparative and International Education*, 1-18.
- Zancajo, A., Verger, A., & Bolea, P. (2022). Digitalization and beyond: the effects of Covid-19 on post-pandemic educational policy and delivery in Europe. *Policy and Society*, 41(1), 111-128.
- Zarkin, G. A. (1985). The Importance of Economic Incentives in the Recruitment of Teachers. Final Report.

## GETTING IN TOUCH WITH THE EU

### In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)

### On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696, or
- by email via: [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)

## FINDING INFORMATION ABOUT THE EU

### Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: [https://europa.eu/european-union/index\\_en](https://europa.eu/european-union/index_en)

### EU publications

You can download or order free and priced EU publications from: <https://op.europa.eu/en/publications>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)).

### EU law and related documents

For access to legal information from the EU, including all EU law since 1952 in all the official language versions, go to EUR-Lex at: <http://eur-lex.europa.eu>

### Open data from the EU

The EU Open Data Portal (<http://data.europa.eu/euodp/en>) provides access to datasets from the EU. Data can be downloaded and reused for free, for both commercial and non-commercial purposes.



■ Publications Office  
of the European Union