Qualified teachers urgently needed

What TIMSS data reveal about teacher qualifications and student learning



' International Task Force on Teachers for Education 2030



Key Messages

→ Teachers in countries with higher national income levels tend to hold higher qualifications. Although the most common qualification for teachers is a bachelor's degree, more than 90% of grade 4 students in several European countries had a teacher with a postgraduate education. But in some middle-income countries, more than one third of students had teachers whom had had only completed upper secondary education.

→ Majors related to pedagogy were the most common type that teachers completed. On average, 75% of grade 4 students in mathematics were taught by teachers who majored in primary education, ranging from 90% or more in European countries to less than two-thirds in some developing countries.

→ More teachers in grade 8 participated in continuing professional development than did teachers in grade 4. In grade 8, between 40% and 60% of students were taught by teachers participating in continuing professional development, compared to between 30% and 40% of students in grade 4.

→ Continuing professional development to equip teachers to deal with distance education and inclusive education is inadequate. While 46% of grade 4 students in mathematics had teachers whom were trained on content, just 35% had teachers trained on technology integration, and although 59% of grade 8 science students had teachers whom were trained on pedagogy, just 44% of students had teachers trained on addressing individual needs.

→ On average, teachers had 17 years of experience in grade 4 and 16 years in grade 8. Teaching experience was longest in some European countries, where 70% of students had teachers with 20 or more years of experience. In some middle-income countries, about one-quarter of students were taught by teachers with fewer than 5 years' experience.

→ Teachers' education level, major, teaching experience and participation in continuing professional development can positively influence learning achievement in some contexts. In general, teachers with higher qualifications, more pedagogical training and more than 10 years of teaching experience are linked to higher learning achievement. However, this relationship is complex and countries should be careful in applying policies that work well in one education context to another.

What is TIMSS?

Teacher quality matters. In fact, it is the most important school-related factor influencing student achievement. However, in order to track teacher quality, more and better indicators are needed. The <u>Trends in</u> <u>International Mathematics and Science Study (TIMSS)</u>, an international assessment of student achievement, can shed light on teacher quality. Established in 1995, TIMSS is conducted every four years by the <u>International Association for Educational Achievement (IEA)</u>. The most recent survey in 2019 covered <u>64 participating countries</u>, representing high- and middle-income economies. It contains a variety of teacher indicators at grade 4 and 8 in mathematics and science based on contextualizing questionnaires including one that specifically addresses teachers.

How TIMSS indicators shed light on SDG Target 4.c and teacher quality

Within the framework of <u>Sustainable Development</u> <u>Goal 4</u> – "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" – target 4.c focuses on teachers. The <u>UNESCO</u> <u>Institute for Statistics (UIS)</u> collects and disseminates internationally comparable data to track progress towards SDG4.c **(Box 1)**.

Indicators 4.c.1 and 4.c.3, which measure the proportions of teachers with minimum pedagogical- and subject-matter content knowledge and skills, respectively, were developed to shed light on teacher quality (<u>UNESCO Institute for Statistics, 2018</u>). The data are based on national qualifications, however, so making international comparisons is difficult without more information about teacher training programmes, including entry prerequisites, duration, content and format. To address this the UIS is developing <u>ISCED-T</u>, a classification system of teacher training programmes, which will generate internationally comparable indicators of teacher quality.

TIMSS data can also enrich our understanding of teacher quality through an expanded set of indicators and better inform policy-making. Aligned to the <u>IEA TIMSS assessment framework</u>, the data do not provide direct measures of teachers as a population, but rather represent the percentage of students with teachers reporting particular characteristics. Moreover, as TIMSS is a learning assessment study that selects whole classrooms and collects extensive information about teacher background and practice, the data provide a unique opportunity to examine the impact of teacher characteristics on learning achievement among a representative sample of students in multiple countries across time. Additionally, TIMSS

Box 1: Sustainable Development Target 4.c

Sustainable Development Target 4.c focuses on teachers: "By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States."

To track progress on target 4.c the following indicators were developed:

- → 4.c.1: Proportion of teachers with the minimum required qualifications, by education level
- → 4.c.2: Pupil-trained teacher ratio by education level
- 4.c.3: Percentage of teachers qualified according to national standards by education level
- → 4.c.4: Pupil-qualified teacher ratio by education level
- → 4.c.5: Average teacher salary relative to other professions requiring a comparable level of qualification
- → 4.c.6: Teacher attrition rate by education level
- → 4.c.7: Percentage of teachers who received in-service training in the last 12 months by type of training

Source: UIS, 2021.

tests students at both grade 4 and grade 8, making it possible to examine the specific impacts of teacher characteristics on achievement at two different stages of their learning.

Based on the latest TIMSS 2019 data collection, this policy brief examines the concept of teacher quality through the following indicators:

- → programme major and specialization;
- → continuing professional development, by type; and
- → teachers' previous experience.

The policy brief also examines the TIMSS student achievement data, comparing student learning across groups based on teacher characteristics in an attempt to establish relationships and draw conclusions about the role of teacher quality on learning.

Initial teacher education

Initial teacher education (ITE) prepares pre-service teachers for their role, and the extent to which they can move across different levels of education and subjects. ITE differs based on the types of qualifications earned, duration, content and format (including use of a practicum) (OECD, 2019). TIMSS includes data on teachers according to their highest level of education based on national definitons of bachelors' degrees, post-graduate degrees and other qualifications. In addition to SDG 4.c.1 indicator, "Percentage of teachers with the minimum required qualifications", this data can shed important light on teacher qualifications and quality. Figure 1 shows the average proportion of teachers by highest level of education in mathematics and science at grade 4 and 8, while **Figure 2** shows the variation between countries in grade 4 mathematics, which was selected for illustration.

→ The majority, or about 60% of students were taught by teachers with a bachelor's degree and this finding was relatively consistent across grades 4 and 8 and in both mathematics and in science (**Figure 1**).

→ Teachers in grade 8 have higher qualifications than teachers in grade 4 since 35% and 38% of students in grade 8 mathematics and science had teachers with a post graduate degree compared to 29% and 28% of students in grade 4.

→ Teachers in grade 4 were more likely to have low qualifications than teachers in grade 8; 15% of grade 4 students in both subjects had teachers who had not completed a bachelor's degree, compared with 5% in grade 8. Among grade 4 students, 5% of teachers had only completed upper secondary education.

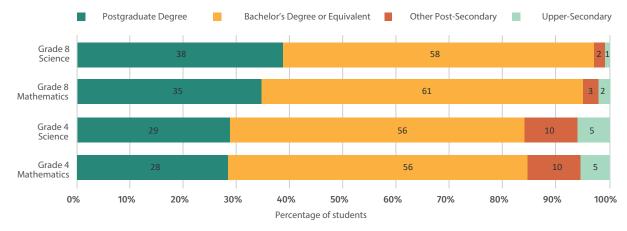


Figure 1: Percentage of students' by teachers' highest level of education achieved, by grade and subject, 2019

→ initial teacher education;

Source: Mullis et al., 2020.

Figure 2: Percentage of students by teachers' highest level of education achieved in grade 4 mathematics, 2019

International Average					
Slovakia					
Poland					
Finland					
Czechia					
Germany					
Georgia					
Bulgaria					
Cyprus					
Albania					
Latvia					
Croatia					
United States					
France					
Russian Federation					
Norway					
New Zealand					
Italy					
Ireland					
Philippines					
Philippines Pakistan					
Lithuania					
United Arab Emirates					
Spain					
Korea, Rep. of					
Hong Kong (China)					
Qatar					
Canada					
Malta					
Bahrain					
Serbia					
Northern Ireland (UK)					
Australia					
Sweden					
Singapore					
Kuwait					_
Iran, Islamic Rep. of					
Chile					
Austria					
Portugal					
Hungary					
Morocco					
Denmark					
Armenia					
Turkey					
Oman					
North Macedonia					
ind (United Kingdom)					
Japan					
Japan Azerbaijan					
snia and Herzegovina					
Montenegro					
Kazakhstan					
Belgium (Flemish)					
South Africa					
Netherlands					
Saudi Arabia					

→ Teachers generally have the highest formal qualification in several European countries. In grade 4 mathematics, 90% or more of students had a teacher with a postgraduate degree in Slovakia (99%), Poland (96%), Finland (93%), Czechia (92%) and Germany (90%) (Figure 2).

→ A bachelor's degree was the highest level of education held by teachers in the majority of countries; this was the case for 9 or more students out of 10 in Belgium (97%), Turkey (94%), United Kingdom (94%), Japan (91%) and Hungary (90%).

→ A post-secondary, tertiary-level education (not equivalent to a bachelor's degree) was the highest qualification in Saudi Arabia where 93% of students were taught by teachers with this qualification; elsewhere about a third or more of students had teachers with a similar qualification in Armenia (44%), Austria (38%), Croatia (37%), Azerbaijan (34%), South Africa (33%) and Pakistan (30%).

→ Teachers' qualifications were lowest in Italy¹, Morocco, Armenia and Pakistan where 59%, 43%, 40% and 36% of students had a teacher with only upper secondary qualifications.

Programme major and specialization

The major or specialisation that teachers complete during their education is important to prepare them for teaching. Pedagogical-content knowledge (Shulman, 1986) is a unique capacity that teachers have so they can relate their pedagogical skills to subject matter content. Since strenghtening pedagogical-content knowledge has been shown to have a positive influence on student learning achievement (Guerriero, 2017), completing a major or specialization in education, pedagogy and other related areas is important for teacher quality. **Figure 3** shows the percentage of grade 4 students in mathematics by teachers' major or specialization during their formal education such as primary education, mathematics, a combination or other fields of knowledge.

→ In grade 4 mathematics, a major in primary education was on average the most common teacher qualification as 75% of students had teachers with this type, followed by a combined major in primary education and major or specialization in mathematics for 32% of students. In comparison, 11% of students had a teacher with just a major in mathematics while 8% had a teacher who majored in another subject. About 6% of students had a teacher with no qualification beyond upper secondary education.

→ Grade 4 mathematics teachers with a combined major/ specialization in primary education and in mathematics represented the majority in a subset of countries. Among high-income countries this includes Sweden, Germany and Singapore, where 77%, 67% and 66% of students had teachers with a double qualification; among middle-income countries this was also the case for 81% and 63% of students in Georgia and Chile.

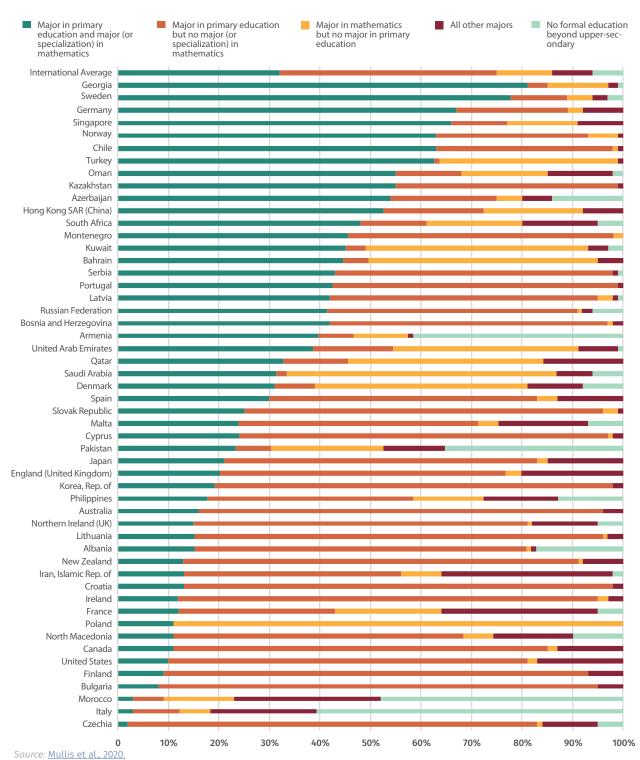
→ Teachers with a major in primary education—but not in mathematics—were most common in several other European countries including Bulgaria where almost 9 in 10 students were taught by teachers with this major. This was also the case for more than 8 in 10 students in Croatia, Czechia, Finland, Ireland and Lithuania.

→ Teachers that majored in mathematics, but not in primary education lack opportunity to develop pedagogical-content knowledge during formal education. In Poland, 89% of grade 4 students in mathematics had teachers whom only completed a major in mathematics but not in primary education. This was also the case in some Arab States including Saudia Arabia (53%), Bahrain (45%), Kuwait (44%) and Qatar (39%).

→ Many teachers lacked opportunity to develop both pedagogical-content knowledge and relevant subject-matter expertise during formal education in Iran, France and Morroco where about one third of grade 4 students in mathematics had a teacher with a major in another subject.

¹Requirements for primary teachers in Italy changed in 2013, before which a university degree was not required. This information can be found in the TIMSS 2019 Encyclopedia and is also in the TIMSS 2015 Encyclopedia exhibit about teacher preparation routes: http://timssandpirls.bc.edu/timss2015/encyclopedia/curriculum-questionnaire-exhibits/main-preparation-routes-and-current-requirements-for-teachers/

Figure 3: Percentage of students by teachers major and/or specialization in grade 4 mathematics, 2019



Continuing professional development

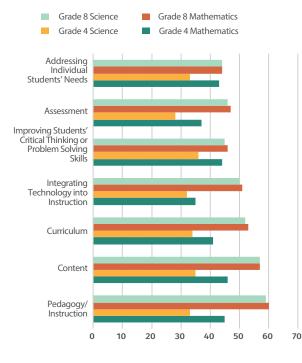
Continuing professional development (CPD) is critical to ensure teachers remain up to date with evolving curricula, pedagogical-content knowledge and administrative norms. Where teachers lack adequate formal training, it plays an even more critical role to ensure teachers acquire required knowledge and skills. A model of CPD contextualised within subjects, targeting specific skills and meeting a minimum duration might be most effective (Yoon et al., 2007). While SDG indicator 4.c.7 measures the proportion of teachers who have received in-service training during the previous 12 months (**Box 1**), TIMSS provides data on CPD disaggregated by type including subject-matter, pedagogical skills, use of ICT and others. **Figure 4** shows teachers' participation in professional development, by type, during the last two years among grade 4 and 8 students in mathematics and science.

→ Teachers in grade 8, on average, had higher participation rates in CPD than teachers in grade 4. In grade 8, roughly 40% to 60% of students were taught by teachers participating in CPD compared to 30% to 40% in grade 4. → Grade 8 teachers' participation in CPD across types differed only marginally between mathematics and science; in contrast, grade 4 teachers' participation in CPD varied with about 40% of students in mathematics having a teacher that participated in CPD compared to about 30% in science.

→ The most common type of CPD for grade 4 mathematics teachers was on content while for science teachers it was related to improving students' critical thinking or inquiry skills as 46% and 36% of students had teachers trained in these areas. The least common type of training reported in both subjects was on assessment - 37% and 28% of students.

→ Training on pedagogy/instruction was the most common training across subjects in grade 8 with 60% and 59% of students in mathematics and science having a teacher trained in this area; the least common type was on addressing students' needs with 44% of students having a teacher trained in this area.

Figure 4: Percentage of students by teachers' participation in professional development, by type, grade and subject, 2019



Source: Mullis et al., 2020.

Note: Teachers of mathematics were asked about their participation in CPD for "Improving students' critical thinking or problem-solving skills" whereas science teachers were asked about participation in CPD for "Improving students' critical thinking or inquiry skills".

Teachers' evolving training needs

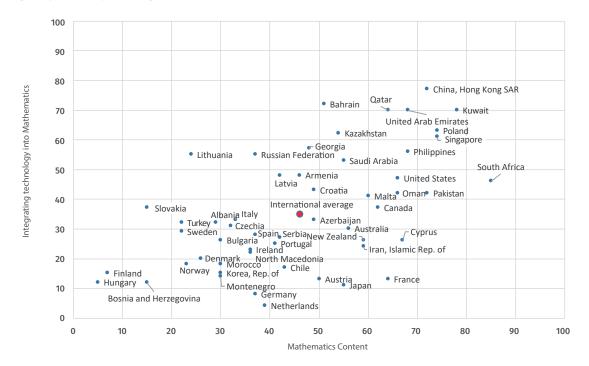
Teachers' training needs to achieve SDG 4 and the teacher target (SDG 4.c) are evolving quickly. COVID-19 and the sudden transition to distance education exposed the digital divide more than ever and exacerbated inequalities in teaching and learning. Training teachers to integrate information and communication technology (ICT) into instruction is increasingly recognised as critical for adapting to the current challenges and transition to distance and hybrid education (UNESCO, UNICEF, World Bank and OECD, 2021). Teachers also need training that helps them address individual learners' needs, build inclusion and mitigate the worst effects of recent changes to teaching and learning, such as lower achievement, higher repetition and dropout. To illustrate other perspectives on teacher quality, **Figure 5** shows country level data of the percentage of students by teachers' participation in CPD on content versus technology integration in grade 4 mathematics. **Figure 6** shows the proportion of students by teachers' participation in CPD on pedagogy/ instruction versus addressing individual learning needs in grade 8 science.

→ In grade 4 mathematics, an average of 46% of students had teachers trained on content compared to 35% on technology integration, representing the most and least common types of CPD.

→ CPD in both areas was most common in China, Hong Kong SAR and in Kuwait where 70% of students or more had teachers that were trained on content and technology integration. This was followed by Qatar and the United Arab Emirates for more than 60% of students.

→ Teachers with the lowest participation rates in CPD were from Finland, Hungary and Bosnia and Herzegovina where fewer than 20% of students had teachers that were trained in either type.

→ Despite a positive relationship between participation rates in CPD, just 13% and 26% of students in France and Cyprus were taught by teachers that trained on technology integration compared to 64% and 67% that trained on content. Figure 5: Percentage of students by teachers' participation in CPD on content versus the integration of technology during the past two years in grade 4 mathematics, 2019



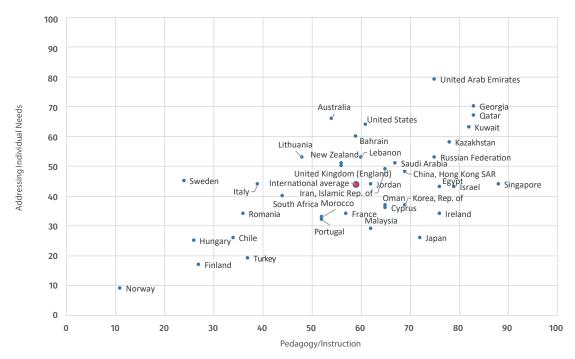
Source: Mullis et al., 2020.

→ In grade 8 science, an average of 59% of students had teachers trained on pedagogy/ instruction compared to just 44% on addressing individual needs, representing the most and least common types of CPD (**Figure 6**).

→ CPD in both types was most common in the United Arab Emirates and in Georgia where 70% of students or more had techers that were trained on pedagogy/ instruction and addressing individual needs. → Teachers with the lowest participation were from Norway where just about 1 in 10 students had a teacher trained in either type of CPD; participation in CPD was also uncommon in Finland and Hungary where about one-quarter or fewer teachers were trained.

→ Despite a positive relationship between participation rates in CPD, just 26% and 29% of students in Japan and Malaysia were taught by teachers trained on addressing individual needs compared to a majority trained on pedagogy/instruction.

Figure 6: Percentage of students by teachers' participation in CPD on pedagogy/instruction versus addressing individual needs during the past two years in grade 8 science, 2019



Teacher experience

Beyond teachers' formal initial teacher education and nonformal continuing professional development, informal learning and experience gained in the classroom over time also enhances teacher quality and effectiveness. Previous research has shown the number of years teaching is positively related to leaning achievement (Clotfelter et al., 2006). Elsewhere, research has suggested that only teachers' early years, when mentoring and corrective action are likely, may be related to improvements in student achievement (Boyd et al. 2006). **Figure 7** shows the percentage of students by teacher experience in years in grade 4 mathematics.

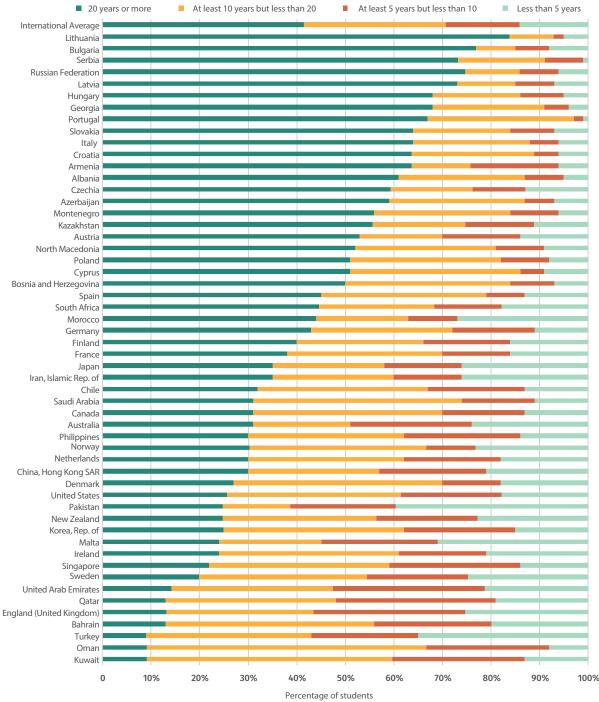
→ On average among all countries, teachers had 17 years of experience in grade 4 and 16 years in grade 8.

→ In grade 4 mathematics, teachers were most experienced in Eastern European countries where more than 70% of students had teachers who had taught for 20 or more years, including Lithuania (83%), Bulgaria (77%), Serbia (74%), Russian Federation (74%) and Latvia (73%).

→ In grade 4 mathematics, teachers had the least experience in some Western European countries where about one-quarter or more students had teachers who had taught for five or fewer years, including Malta (31%), England (United Kingdom) (25%) and Sweden (25%). This was also the case in Morocco (27%), Iran (26%) and Japan (26%).

→ The teacher workforce was least experienced in Turkey and Pakistan where 35% and 40% of students had teachers who had taught for five or fewer years.

Figure 7: Percentage of students by teachers' experience in number of years in grade 4 mathematics, 2019



Teacher quality and its relationship to student learning achievement

For some time researchers have tried to identify and isolate factors that have a positive effect on student outcomes, particularly learning achievement (Széll, 2013). Since teachers are regarded as the single most important school level factor affecting education quality, understanding the different contributions of teachers and the role of their qualifications is key. Without directly quantifying teachers' knowledge and skills, researchers including TIMSS have relied on proxies for teachers qualifications such as their level of education, major or core specialization, ongoing training and teaching experience. In order to better understand the relationship between teacher qualifications and learning achievement, **Figure 8** shows students' standardized learning achievement scores in both subjects at both grades across countries.

→ On average across countries student achievement in mathematics in grade 4 and grade 8 and science in grade 4 was highest for those taught by teachers with a major that focused on acquisition of pedagogical-content knowledge. This was followed by students taught by teachers with knowledge of subject-matter content, but not in pedagogical-content, and by teachers that completed other majors. Students whose teachers did not go beyond upper-secondary education had the lowest average achievement.

→ In grade 8 science, student achievement was highest for those taught by teachers with a major in both pedagogical-content and subject-matter, followed by those with a major in subject-matter but not pedagogical content or in other areas. Students whose teachers did not go beyond upper-secondary education had the lowest average achievement.

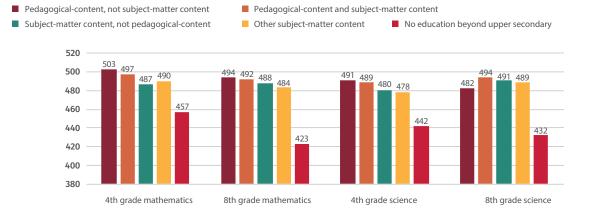


Figure 8: Student learning achievement in mathematics and science in grade 4 and 8, 2019

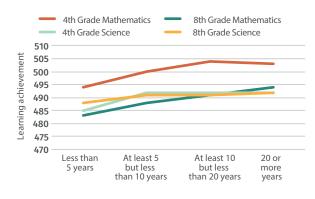
Source: <u>Mullis et al., 2020.</u>

Note: Adapted from TIMSS: pedagogical content refers to majors in primary education in grade 4, and to majors in mathematics education and science education in grade 8; subject-matter content refers to majors in mathematics and science.

→ In terms of the impact of teaching experience, Figure 9 shows that on average student achievement was higher for those taught by teachers with more years experience. However this trend tends to diminish over time, particularly past 10 years.

→ National level data show no clear relationship between teachers' major and average achievement in mathematics and science in most countries, however, an analysis by <u>Burroughs et al. (2019)</u> shows that teachers' highest level of education, major and experience significantly affected students' mathematics achievement in 13 of 40 TIMSS countries in grade 4, and in 14 of 38 countries in grade 8. In these countries, mathematics teachers with a higher level degree who majored in mathematics and had more years in experience had a larger effect on students' mathematics achievement. → In the same analysis, the relationship between participation in continuing professional development activities and learning achievement was weaker as participation in CPD only statistically increased student mathematics achievement in 8 of 40 countries in grade 4, and 7 of 38 countries in grade 8.

Figure 9: Learning achievement by years of teaching experience in Grade 4 and Grade 8 by subject, 2019



Policy Recommendations

Policy-makers and researchers should be cautious about applying results from aggregated data or from individual education systems to other, very different educational contexts. The lack of clear relationships between teacher characteristics and learning achievement suggests that teachers with similar education, training and experience may nevertheless lead to very different outcomes. In identifying factors that contribute to student performance, governments should closely examine high-performing countries alongside countries with similar contexts to their own. Furthermore, findings should not be interpreted in a way that puts too much responsibility for perceived educational ills on teachers. Student achievement is shaped by the totality of the education system itself, as well as by the social structures upon which it rests. While teachers are essential to education outcomes, parents, policy-makers, community institutions and cultural contexts also play powerful roles. Some general recommendations, however, include the following:

→ Policy-makers can improve teacher qualifications by improving the quality of initial teacher education, including by increasing the minimum required level to a bachelor's degree. Teacher training programmes should include majors fostering the development of pedagogical-content knowledge as well as specific subject matter expertise to ensure teachers develop the appropriate set of skills and knowledge they need to be effective in the classroom. Teacher training programmes should also include ongoing practicum experiences led by experienced teachers to help pre-service teachers integrate their theoretical knowledge in the classroom.

→ In-service teachers without formal preparation in teaching require a rigorous induction period, frequent CPD interventions and mentoring opportunities. All teachers need better access to equitable, targeted and regular CPD interventions to support them in enhancing their instruction.

→ Prolonged school closures have led to learning loss and other negative outcomes, so training on integrating technology and on inclusive education and addressing individual needs should be enhanced. Countries should also consult with teachers and their representatives through social dialogue to ensure that teachers have input in defining the training that they need.

→ Teachers with more years of experience can help novice teachers by playing a leadership role in peer learning, knowledge-sharing, coaching, monitoring and contributing to formative evaluations. Countries should provide incentives to ensure more experienced teachers and those with higher qualifications remain in the profession, given their potential impact on learning and the significant costs associated with preparing new recruits.

→ International Standard Classification of teacher training programmes (ISCED-T), which is being developed by the UNESCO Institute for Statistics (UIS), will provide a new classification system for teacher education programmes to shed light on the teacher qualifications discussed in this policy brief. It will help to generate new indicators of teacher quality that can be used to measure and benchmark progress towards the achievement of the SDG4.c teacher-related target as well as for analysis in the achievement of the overall SDG4 target on education and other Sustainable Development Goals.

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The International Task Force on Teachers for Education 2030 (also known as Teacher Task Force) is a global and independent alliance. Members are national governments, intergovernmental organizations, non-governmental organizations, international development agencies, civil society organizations, private sector organizations and UN agencies that work together to promote teacher-related issues.

The Teacher Task Force Secretariat is hosted by UNESCO's Headquarter in Paris.

For more information, see: www.teachertaskforce.org

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