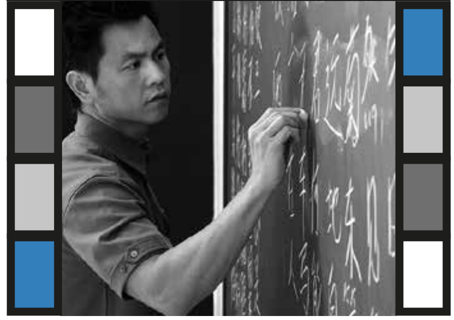


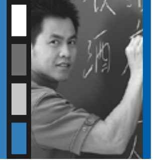
Chapter 3

ENABLING PEDAGOGIES FOR THE FUTURE

At the heart of education is pedagogy. Many teachers have a good sense of the kind of pedagogies on which 21st century learning hinges, but there is a major gap between intended and implemented practices. How can education systems create the conditions for encouraging and supporting teachers to initiate, share, and evaluate innovative pedagogies and curricula, including new technologies? What are the implications of new pedagogies for the roles of teachers and students? What are the implications of pedagogical innovation and innovative learning environments for the roles of governments and the profession/unions? What are the implications of new pedagogies and curricula for school and system evaluation? These are important issues that the 2018 International Summit on the Teaching Profession seeks to tackle in its second session.

Note regarding Israel

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.



TEACHER PROFESSIONAL COMPETENCE

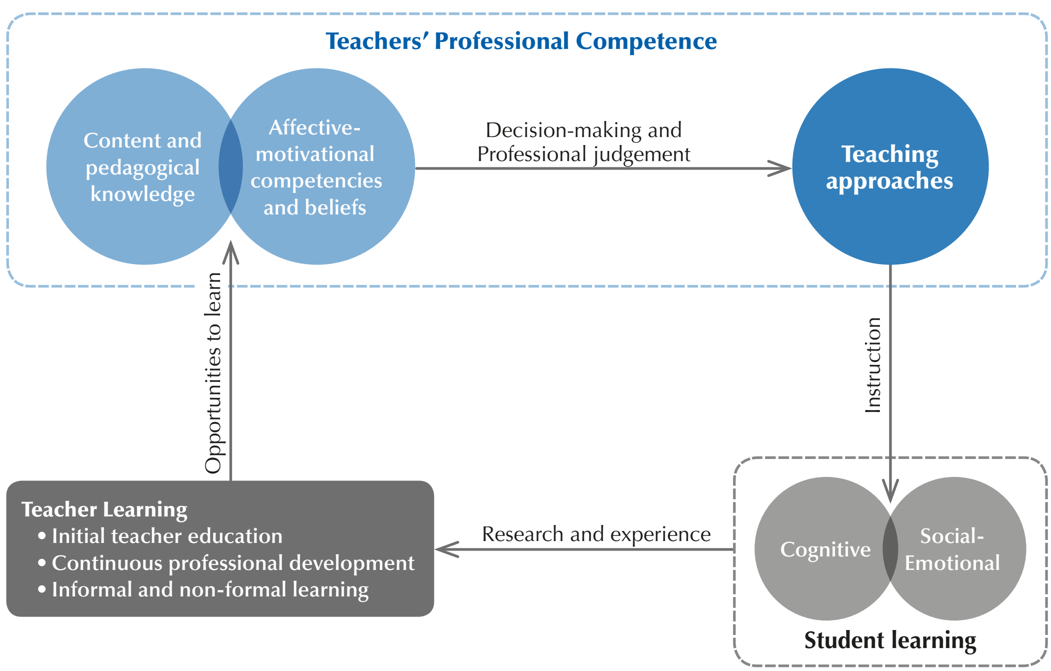
Enhancing what and how students learn requires enhancing pedagogy, and enhancing pedagogy is ultimately about developing teachers' professional competence. It can be defined as "the ability of teachers to meet complex demands in a given context by mobilising various psychosocial (cognitive, functional, personal and ethical) resources." Teachers' professional competence shapes instructional processes and is, in turn, shaped by the opportunities and incentives teachers have to learn (Figure 3.1).

Research and experience of teachers continuously feed into the knowledge base that is transferred to and also co-constructed by teachers, through individual and collective learning. Teachers' learning opportunities shape not only their knowledge of the subject(s) they teach and pedagogy in general, but also their beliefs about teaching and other motivational and affective competences. Teachers draw on such knowledge and competences to make decisions in the classroom.

Professional judgement guides the subsequent teaching approaches, which include curriculum and lesson planning, selecting and applying sets of teaching methods, classroom management and student assessment. Instruction is, in turn, the implementation of teaching approaches, as manifested in interactions with students, teacher behaviour and the tools and materials used in the classroom. This then influences both cognitive and socio-emotional aspects of student learning.

Figure 3.1

Conceptual framework of teachers' professional competence



Source: Guerriero, S. and N. Révai (2017), "Knowledge-based teaching and the evolution of a profession", in *Pedagogical Knowledge and the Changing Nature of the Teaching Profession*, http://dx.doi.org/10.1787/9789264270695-13-en.

This chapter examines some of these dimensions more closely, to identify policy levers through which effective pedagogies for 21st century learning can be enabled and supported. It starts with a look at how well-prepared incoming teachers feel and then reviews some data from PISA on teacher-directed and student-oriented learning, as well as gaps between intended and implemented pedagogical practice. After that, it presents initial findings from a first assessment of teachers' general pedagogical knowledge and then concludes with some policy levers to shape innovative learning environments.

HOW WELL DO NEW TEACHERS FEEL PREPARED FOR TEACHING?

Examining to what extent new teachers feel prepared for their job provides a starting point for reviewing teachers' professional competence.

When new teachers start teaching, they often bring energy and enthusiasm into their classrooms. However, the first phase of their careers can be strenuous and stressful, as they have limited experience for coping with many new and challenging situations. It is not surprising, then, that new teachers in most countries report lower levels of confidence than their more experienced peers. Some even experience burn-out early in their careers and, in some countries, more than a third of new teachers leave the profession within the first five years.

On average, new teachers with a maximum of three years' work experience comprise about 10% of the total teacher population across the countries and economies that participated in the 2013 OECD Teaching and Learning International Survey (TALIS). Italy (3%), Portugal (1%) and Spain (3%) have the smallest proportion of new teachers across participating countries and economies. Singapore (30%) has the biggest proportion of new teachers, followed by England (United Kingdom) (16%).

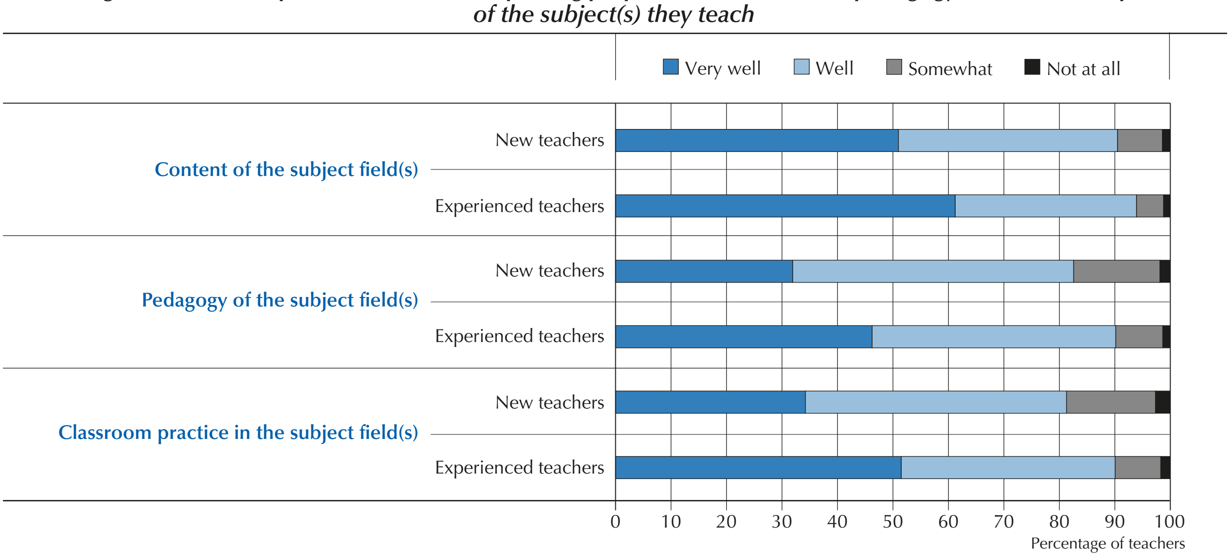
Feelings of preparedness of new versus experienced teachers

Teachers were asked to rate their feelings of preparedness ("not at all", "somewhat", "well" and "very well") in three domains: content, pedagogy and classroom practice of the subject field(s) they teach. Figure 3.2 compares the responses of new and experienced teachers in each domain. Overall, most teachers seem fairly confident. More than 80% of new teachers report that they feel "well" or "very well" prepared in all three domains, and over 90% of experienced teachers do so. It is not surprising that experienced teachers report significantly higher levels of preparedness than new teachers, but differences in reported levels of preparedness between new and experienced teachers display some interesting patterns across domains. New teachers are more likely to feel prepared in the content of the subject field(s) compared to the pedagogy or classroom practice of the subject field(s).

Figure 3.2

Feelings of preparedness of new versus experienced teachers

Percentage of new and experienced teachers reporting preparedness in content, pedagogy and classroom practices of the subject(s) they teach



Source: OECD (2017a), "Do new teachers feel prepared for teaching?", *Teaching in Focus,* No. 17, http://dx.doi.org/10.1787/980bf07d-en.

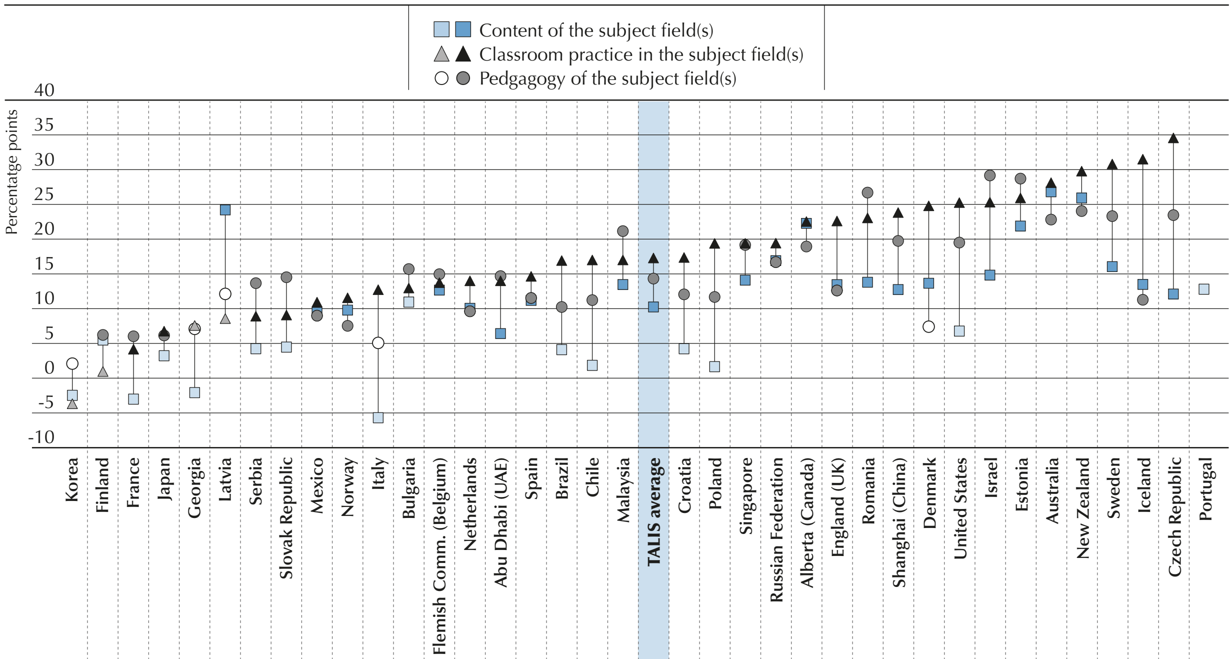
Preparedness in content of the subject field(s)

Both new and experienced teachers report better preparedness in the content rather than the pedagogy and classroom practice of the subject field(s) they teach. More than 90% of both new and experienced teachers report feeling "well" or "very well" prepared in the content of their subject field(s). As shown in Figure 3.3, significant differences in feelings of preparedness for the content knowledge domain between the two groups of teachers are found in only 22 of the 37 TALIS 2013 countries and economies, whereas there are significant differences in more than 32 countries and economies in the other two domains: pedagogical and practical knowledge to teach subjects.

Figure 3.3

Gaps in feelings of preparedness between new and experienced teachers

Differences in percentage points between the proportion of new and experienced teachers who reported feeling "very well" prepared in content, pedagogy and classroom practices of the subject(s) they teach



Notes: Items for which the gaps are not statistically significant at 5% are presented in a darker tone in this figure.
This figure does not present the results when sampling variability of the estimate was too high for reporting with greater than 33.3% of coefficient of variation.
Data are ranked in ascending order according to the differences in proportion of new and experienced teachers who reported feeling "very well" prepared in classroom practice in the subject field(s).
Source: OECD (2017a), "Do new teachers feel prepared for teaching?", *Teaching in Focus,* No. 17, http://dx.doi.org/10.1787/980bf07d-en.

Preparedness in pedagogy of the subject field(s)

In many participating countries and economies, the largest difference in reported preparedness between new and experienced teachers is in the pedagogy of the subject field(s) they teach. Differences, for this domain between new and experienced teachers are largest in Israel (30 percentage points), Estonia (29 percentage points), Romania (27 percentage points) and Malaysia (21 percentage points). In contrast, differences between new and experienced teachers are only 6 percentage points in Finland, France and Japan. In Italy and Korea, no statistically significant differences are found. The magnitude of some of these differences suggests that new teachers may require more support to develop effective pedagogical strategies for teaching content in some countries than in others, possibly due to limited pre-service or in-service training.

Preparedness in classroom practice of the subject field(s)

In more than half of TALIS 2013 countries and economies, the largest difference in reported preparedness between new and experienced teachers is in classroom practice of the subject field(s) they teach. In countries such as the Czech Republic, Iceland and Sweden, the gaps between the proportion of new and experienced teachers feeling "very well" prepared in classroom practice in the subject field(s) are greater than 30 percentage points. However, in France (4 percentage points) and Japan (7 percentage points), the differences between the groups are much smaller, and there are no statistical significant differences in Finland and Korea. These results may reflect prospective teachers' exposure to teaching as part of pre-service education and/or different levels of support provided to new teachers as part of in-service training.

TEACHER-DIRECTED AND STUDENT-ORIENTED LEARNING

The preceding analysis suggests that teacher education institutions in many countries and economies may give insufficient attention to pedagogical content knowledge, general pedagogical knowledge or new knowledge emerging from educational science. But the data reflect only teachers' feelings of preparedness. It is much harder to find systematic evidence on the actual prevalence of pedagogies in classrooms.

The traditional view of a classroom that has existed for generations in schools around the world consists of students sitting at desks, listening as the teacher stands in the front of the class and lectures or demonstrates something on a board or screen. The teacher has planned the lesson, knows the content he or she needs to cover and delivers it to the students, who are expected to master that content and apply it to their homework or a test. This kind of teacher-directed instruction might also include things like lectures, lesson summaries or question-and-answer periods that are driven by the teacher.

But for decades now, educationalists have encouraged giving students more control over the time, place, path and pace of learning. Thus student-oriented teaching strategies are increasingly finding their way into classrooms of all subjects.

What types of teaching strategies are being used to teach mathematics in schools around the world? And which one should teachers be using for what purpose? Data from the PISA 2012 assessment indicate a prevalence of teacher-directed methods, but deciding how to teach mathematics is not as simple as choosing between one strategy and another. Teachers need to consider both the content and the students to be taught when choosing the best teaching strategy for their mathematics lessons.

Where does mathematics teaching fall in the debate on teacher-directed versus student-oriented learning?

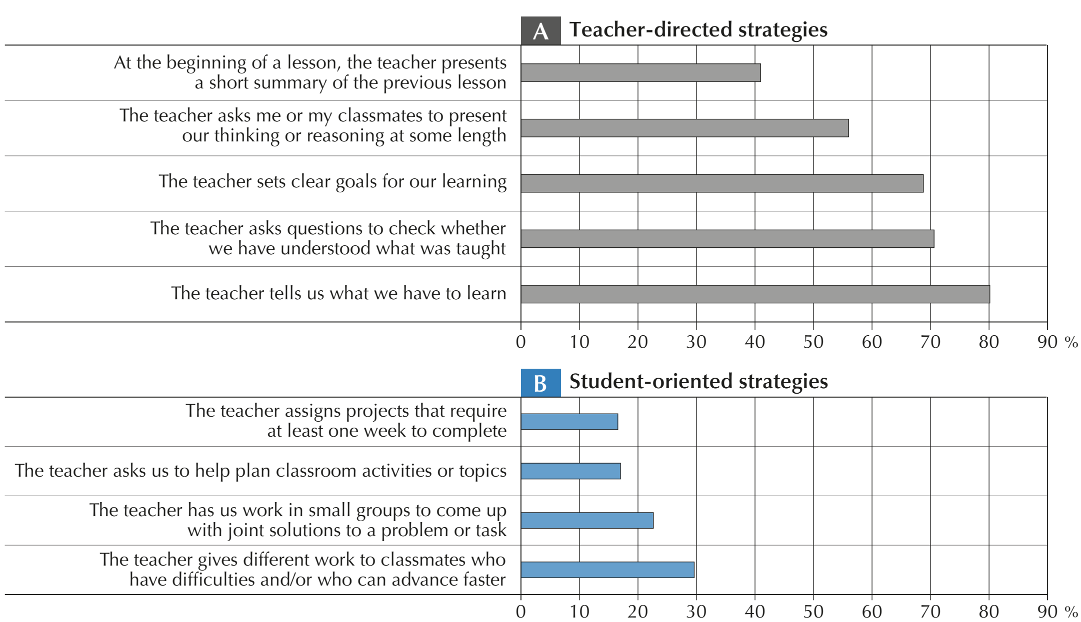
In PISA, students were asked about the frequency with which their teachers use student-oriented or teacher-directed strategies in their lessons. The results indicate that, teacher-directed practices are used widely. For instance, across OECD countries, eight out of ten students report that their teachers tell them what they have to learn in every lesson, and seven out of ten students have teachers who ask questions in every lesson to check that students understand what they are learning.

On the other hand, the student-oriented practice that teachers most commonly use is assigning students different work based on their ability, commonly called differentiated instruction. However, according to students, this practice is used only occasionally, as fewer than one in three students in OECD countries report that their teachers use this practice frequently in their lessons. Figure 3.4 shows the reported frequency of both teacher-directed and student-oriented instructional strategies for mathematics.

Figure 3.4

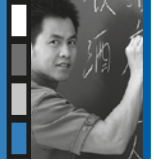
Teacher-directed and student-oriented instruction

Percentage of students who responded "in every lesson" or "in most lessons", OECD average



Note: The OECD average includes all member countries of the OECD except Latvia.

Source: OECD (2012), PISA 2012 Database, adapted from Echazarra, A. et al. (2016), "How teachers teach and students learn: Successful strategies for school", *OECD Education Working Papers*, No. 130, http://dx.doi.org/10.1787/5jm29kpt0xxx-en.

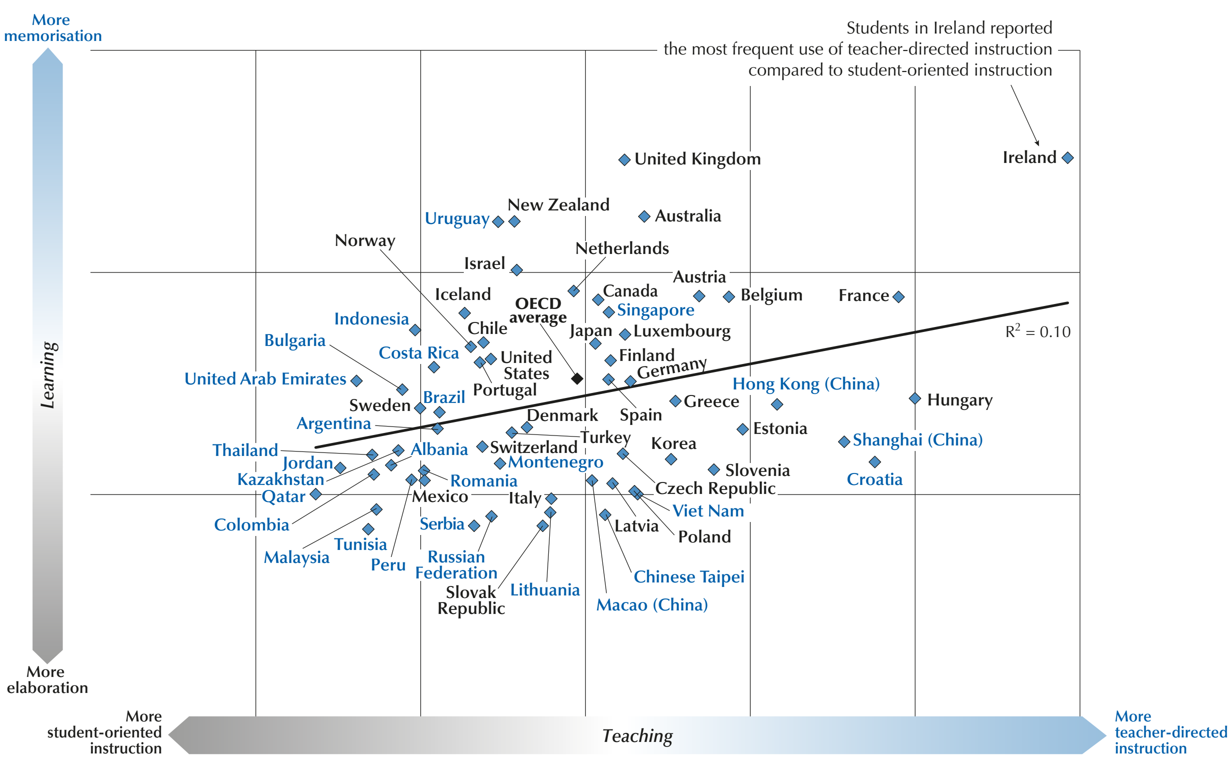


The PISA survey also indicates that students may be exposed to different teaching strategies based on their socio-economic status or gender. For example, girls report being less frequently exposed to student-oriented instruction in mathematics class than boys do. Conversely, disadvantaged students, who are from the bottom quarter of the socio-economic distribution in their countries, report more frequent exposure to these strategies than advantaged students do. Teachers might have reasons for teaching specific classes in the ways they do, and other factors, such as student motivation or disruptive behaviour, might be at play too. Ideally, however, all students should have the opportunity to be exposed to some student-oriented strategies, regardless of their gender or social status. Also, when considering an entire country, the more frequently teacher-directed instruction is used compared with student-oriented instruction, the more frequently students learn using memorisation strategies (Figure 3.5).

Figure 3.5

How teachers teach and students learn

Results based on students' reports



Note: The OECD average includes all member countries of the OECD except Latvia.

Source: OECD (2016), *Ten Questions for Mathematics Teachers ... and How PISA Can Help Answer Them*, Figure 1.2, http://dx.doi.or/10.1787/9789264265387-en.

Which teachers use active-learning teaching practices in mathematics?

The TALIS study asked mathematics teachers in eight countries about their regular teaching practices (Figure 3.6). The study included four active-learning teaching practices that overlap in large part with student-oriented practices: placing students in small groups, encouraging students to evaluate their own progress, assigning students long projects, and using information and communication technology (ICT) for class work. These practices have been shown by many research studies to have positive effects on student learning and motivation. TALIS data show that teachers who are confident in their own abilities are more likely to engage in active-teaching practices. This is a somewhat logical finding, as active practices could be thought of as more risky than direct-teaching methods. It can be challenging to use ICT in your teaching or have students work in groups if you are not confident that you have the skills needed in pedagogy, content or classroom management.

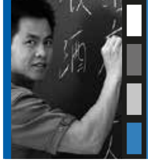
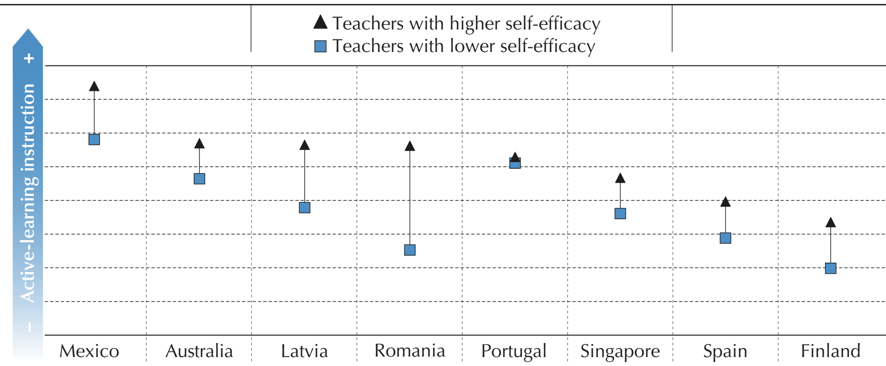


Figure 3.6

How teachers' self-efficacy is related to the use of active-learning instruction



Notes: All differences are statistically significant, except in Portugal and Singapore.
Teachers with higher/lower self-efficacy are those with values above/below the country median.
The *index of active-learning instruction* measures the extent to which teachers use "information and communication technologies in the classroom", let "students evaluate their own progress", work with "students in small groups to come up with a joint solution to a problem" or encourage students to work on long projects.
The *index of self-efficacy* measures the extent to which teachers believe in their own ability to control disruptive behaviour, provide instruction and foster student engagement.
Countries are ranked in descending order of the frequency with which teachers with higher self-efficacy use active-learning instruction.
Source: OECD (2016), *Ten Questions for Mathematics Teachers… and How PISA Can Help Answer Them,* Figure 1.3, http://dx.doi.org/10.1787/9789264265387-en.

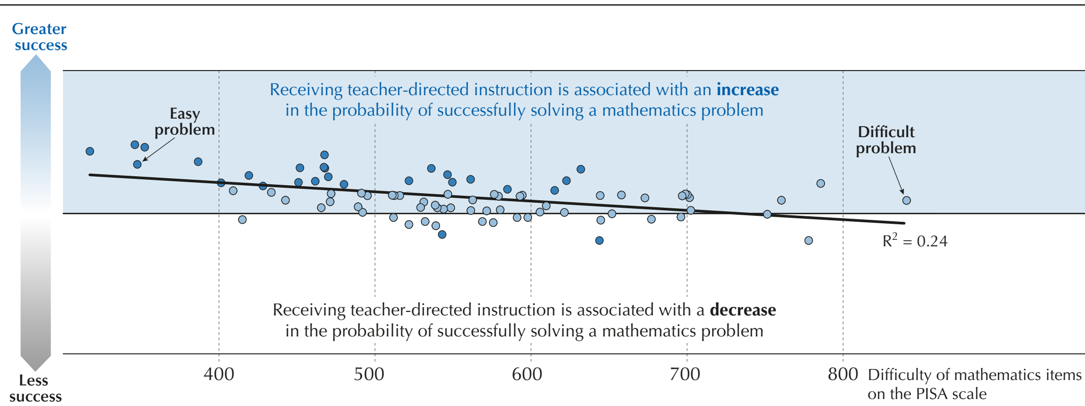
How can a variety of teaching strategies benefit student achievement?

When looking at students' mean mathematics scores on the PISA assessment, along with their exposure to the teaching strategies discussed in this chapter, another reason for using a variety of teaching strategies emerges. The data indicate that when teachers direct student learning, students are slightly more likely to be successful in solving the easiest mathematics problems in PISA. Yet as the problems become more difficult, students with more exposure to direct instruction no longer have a better chance of success. Figure 3.7 shows the relationship between the use of teacher-directed strategies and students' success on mathematics problems of varying difficulty. Therefore, just as one teaching method is not sufficient for teaching a class of students with varying levels of ability, a single teaching strategy will not work for all mathematics problems either. Past research into the teaching of mathematics supports this claim too, suggesting that teaching complex mathematics skills might require different instructional strategies than those used to teach basic mathematics skills. Some recent evidence suggests that more modern teaching methods, such as student-oriented teaching strategies, encourage different cognitive skills in students.

Figure 3.7

Teacher-directed instruction and item difficulty

Odds ratio, after accounting for other teaching strategies, OECD average



Note: Statistically significant odds ratios are marked in a darker tone. Chile, Latvia and Mexico are not included in the OECD average.
Source: OECD (2012), PISA 2012 Database, adapted from Echazarra, A. et al. (2016), "How teachers teach and students learn: Successful strategies for school", *OECD Education Working Papers*, No. 130, http://dx.doi.org/10.1787/5jm29kpt0xxx-en.

Some countries, such as Singapore, are taking this research to heart and are designing mathematics curricula that require teachers to use a variety of teaching strategies (Box 3.1). Yet rather than doing away with more traditional, teacher-directed teaching methods altogether, these methods should be used in tandem. In other words, teachers need a diverse set of tools to teach the breadth of their mathematics curriculum and to help students advance from the most rudimentary to the most complex mathematics problems.

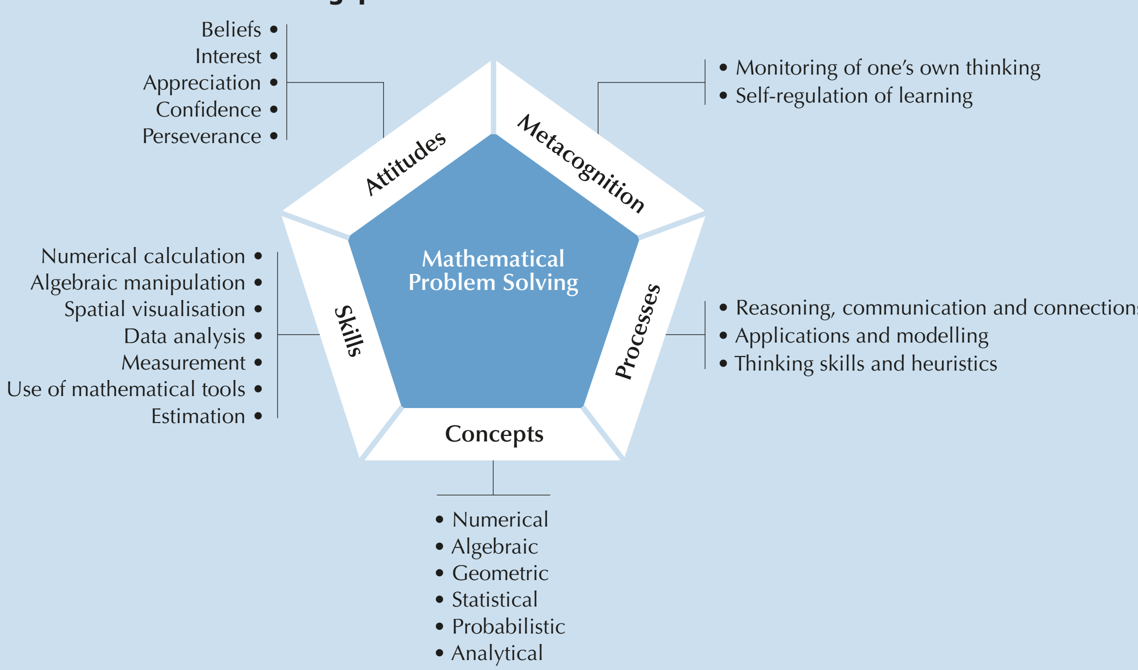
It is interesting that teacher-directed approaches are better predictors for cognitive learning outcomes, while student-oriented approaches are better predictors for important social and emotional outcomes, including career expectations.

Box 3.1 Teaching and learning strategies for mathematics in Singapore

The objective of the mathematics curriculum in Singapore is to develop students' ability to apply mathematics to solve problems, by developing their mathematical skills, helping them acquire key mathematics concepts, fostering positive attitudes towards mathematics and encouraging them to think about the way they learn. To accomplish this objective, teachers use a variety of teaching strategies in their approach to mathematics. Teachers typically provide a real-world context that demonstrates the importance of mathematical concepts to students (thereby answering the all-too-common question: "Why do I have to learn this?"). Teachers then explain the concepts, demonstrate problem-solving approaches and facilitate activities in class. They use various assessment practices to provide students with individualised feedback on their learning.

Students are also exposed to a wide range of problems to solve during their study of mathematics. In this way, students learn to apply mathematics to solve problems, appreciate the value of mathematics and develop important skills that will support their future learning and their ability to deal with new problems.

Singapore mathematics curriculum framework



Source: OECD (2016), *Ten Questions for Mathematics Teachers… and How PISA Can Help Answer Them*, http://dx.doi.org/10.1787/9789264265387-en.

THE GAP BETWEEN INTENDED AND IMPLEMENTED LEARNING STRATEGIES

The dilemma for educators is that routine cognitive skills (the skills that are easiest to teach and easiest to test) are exactly the skills that are also easiest to digitise, automate and outsource. There is no question that state-of-the-art knowledge and skills in a discipline will always remain important. Innovative or creative people generally have specialised skills in a field of knowledge or a practice. And as much as learning-to-learn skills are important, we always learn by learning something.

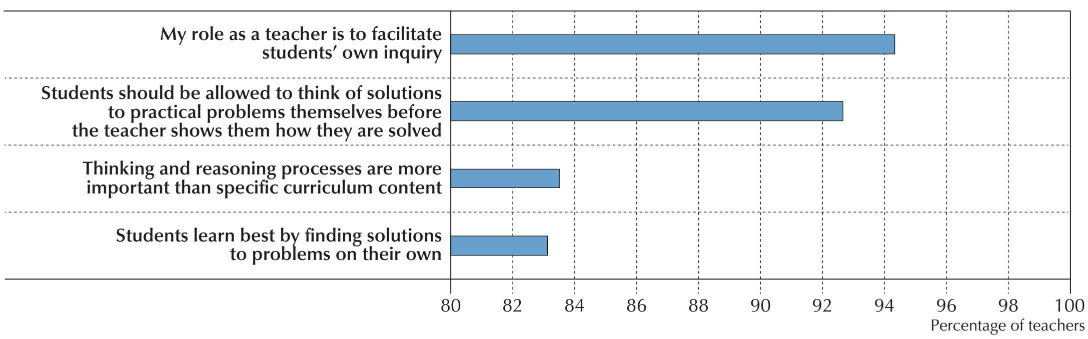
However, educational success is no longer about reproducing content knowledge, but about extrapolating from what we know and applying that knowledge creatively in novel situations, and about thinking across the boundaries of subject-matter disciplines. If everyone can search for information on the Internet, the rewards now come from what people do with that knowledge.

Teachers seem to have internalised that and report that they predominantly believe in constructivist approaches to learning. As shown in Figure 3.8, overall, there is strong agreement among teachers that it is their role to facilitate inquiry in the student (94% on average). Also, a majority of teachers believe that students should be allowed to think of solutions themselves before teachers show them (93%). The rate of agreement was mixed across the other variables, but it was generally above 80% across countries for beliefs related to students being able to find their own solutions and that thinking and reasoning skills are more important than content.

Figure 3.8

Teachers' beliefs about teaching and learning

Percentage of lower secondary education teachers who "agree" or "strongly agree" with the following statements



Items are ranked in descending order, based on the percentage of teachers who "agree" or "strongly agree" with the statement.
Source: OECD (2014a), *TALIS 2013 Results: An International Perspective on Teaching and Learning*, Figure 6.8, http://dx.doi.org/10.1787/9789264196261-en.
StatLink http://dx.doi.org/10.1787/888933042048

So far so good, but when PISA asked students to report on the prevalence of different approaches to what actually happens in the classroom, the picture was often at odds with what teachers reported to be desirable learning strategies. For example, teachers in England (United Kingdom) reported a strongly constructivist view of teaching, but England was among the countries where students reported the highest prevalence of memorisation strategies (Figure 3.9). The pattern is similar for many other English-speaking countries.

In short, in some countries there is a significant gap between what teachers report to be desirable pedagogies and what actually happens in classrooms.

Who uses memorisation the most?

There are many reasons why students use particular learning strategies, or a combination of them, when learning mathematics. Among students who mainly use memorisation, drilling or repetitive learning, some may do so to avoid intense mental effort, particularly if they are not naturally drawn to mathematics, are not familiar with more advanced problems or do not feel especially confident in their own abilities in the subject. To some extent, PISA results support this hypothesis. They indicate that, across OECD countries, persevering students, students with positive attitudes, motivation or interest in problem solving and mathematics, students who are more confident in their mathematics abilities and students who have little or no anxiety towards mathematics are somewhat less likely to use memorisation strategies. Boys, too, are less likely than girls to use these strategies; in fact, in no education system did boys report more intensive use of memorisation when learning mathematics than girls (Figure 3.10).

When looking at students' self-reported use of memorisation strategies across countries, the data also show that many countries that are among the highest performers in the PISA mathematics exam are not those where memorisation strategies are the most dominant. For example, fewer students in East Asian countries reported that they use memorisation as a learning strategy than did 15-year-olds in some of the English-speaking countries to which they are often compared.

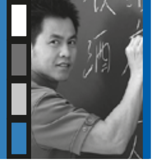
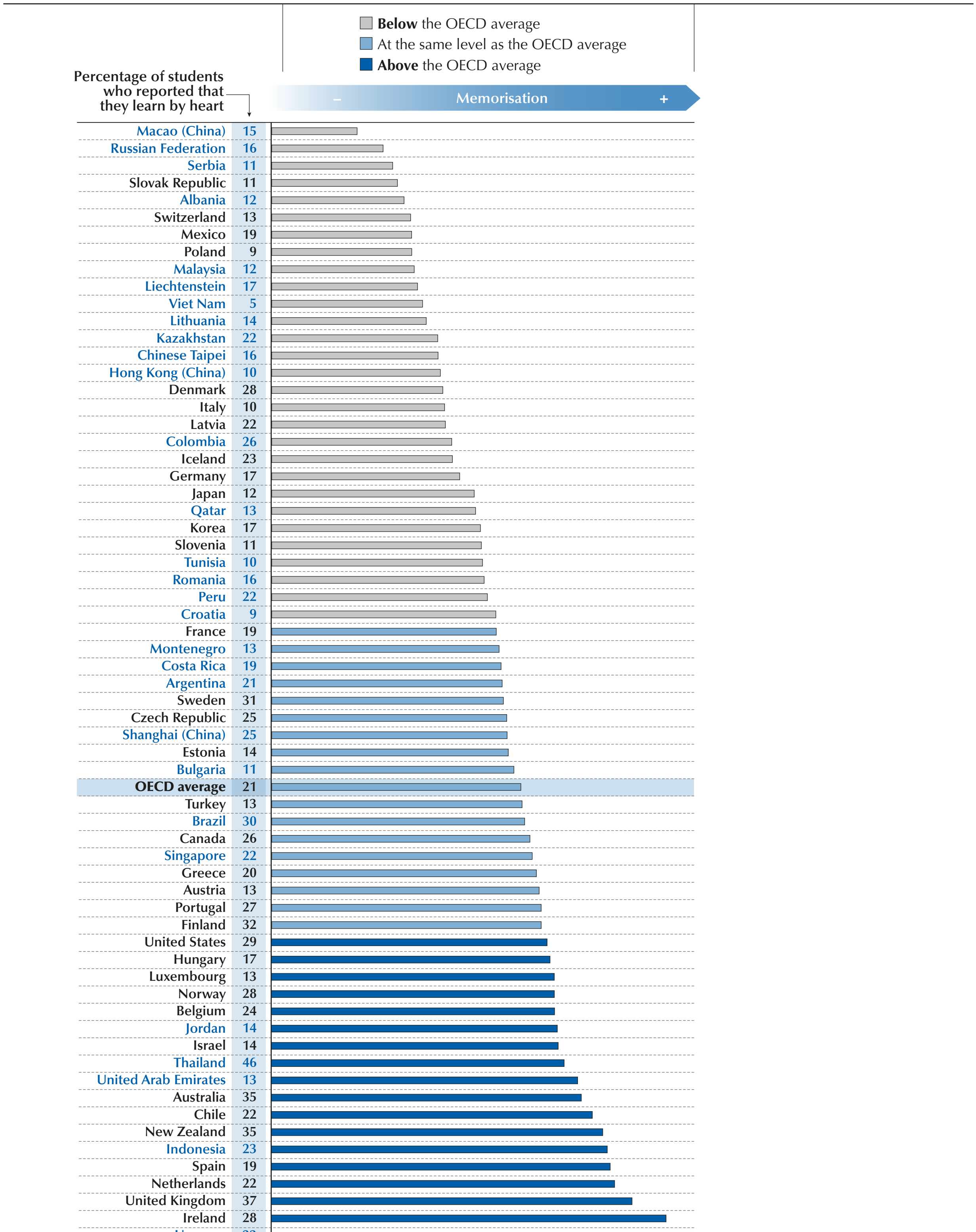


Figure 3.9

Students' use of memorisation strategies

Based on students' self-reports

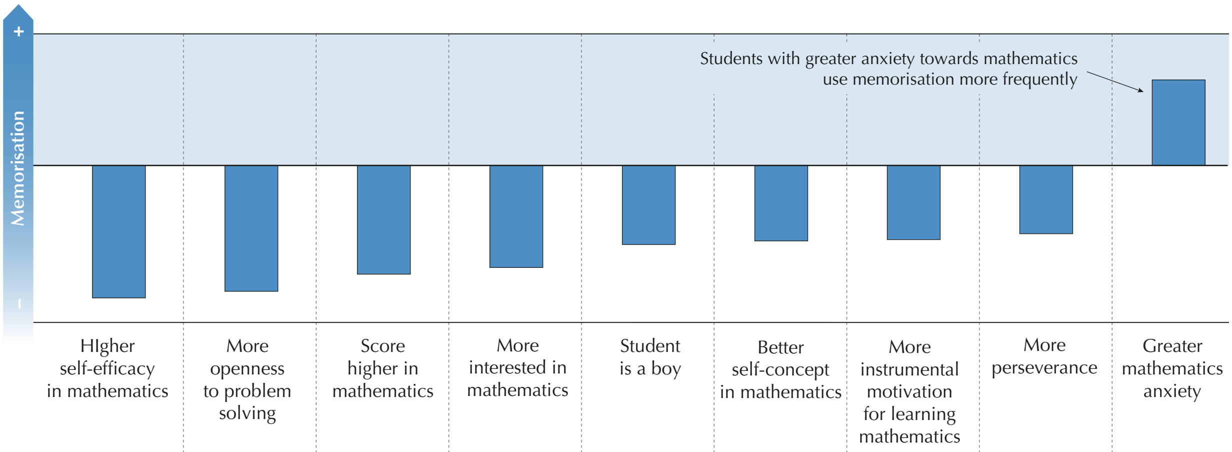


Source: OECD (2016), *Ten Questions for Mathematics Teachers… and How PISA Can Help Answer Them,* Figure 4.1, http://dx.doi.org/10.1787/9789264265387-en.

Figure 3.10

Who is using memorisation?

Correlation with the index of memorisation, OECD average



Source: OECD (2016), *Ten Questions for Mathematics Teachers… and How PISA Can Help Answer Them,* Figure 4.2, http://dx.doi.org/10.1787/9789264265387-en.

These findings may run counter to conventional wisdom, but mathematics instruction has changed considerably in many East Asian countries, such as Japan (Box 3.2).

Box 3.2. Mathematics teaching in Japan

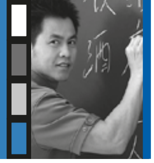
Mathematics teaching in Asian countries has historically been regarded as highly traditional, particularly by many western observers. Whether accurate or not, the typical image of Japanese education often includes highly competitive entrance exams, cram schools and rote memorisation. However, Japanese education has gradually evolved into a system that promotes the acquisition of foundational knowledge and skills and encourages students to learn and think independently, which is one of the ideas behind the "Zest for Living" reform. In Japanese education today, academic and social skills refer to: the acquisition of basic and foundational knowledge and skills; the ability to think, make decisions and express oneself to solve problems; and being motivated to learn. For example, the Period for Integrated Studies policy, which asks teachers and schools to develop their own cross-curricular study programmes, encourages students to participate in a range of activities (including volunteer activities, study tours, experiments, investigations, and presentations or discussions) with the aim of developing students' ability to recognise problems, learn and think independently and improve their problem-solving skills.

Source: Schleicher A. (forthcoming), *Worldclass: How to build a smart school system*.

Will memorisation help or hinder student learning?

Some experts in mathematics education consider memorisation to be an elementary strategy that is better suited to solving routine problems that require only a shallow understanding of mathematics concepts. PISA results reinforce this view. They show that students who report using memorisation strategies are indeed successful on easier mathematics tasks. For example, one of the easiest mathematics problems in the PISA 2012 assessment was a multiple-choice question involving a simple bar chart. Some 87% of students across the education systems participating in PISA answered this question correctly. Students who report that they use memorisation strategies to learn mathematics have about the same success rate on this easy item as students who report using other learning strategies.

Although memorisation seems to work for the easiest mathematics problems, its success as a learning strategy does not extend much beyond that. According to the data, as problems become more challenging, students who use memorisation are less likely to be able to solve them correctly. Results are even worse for the most challenging mathematics problems.

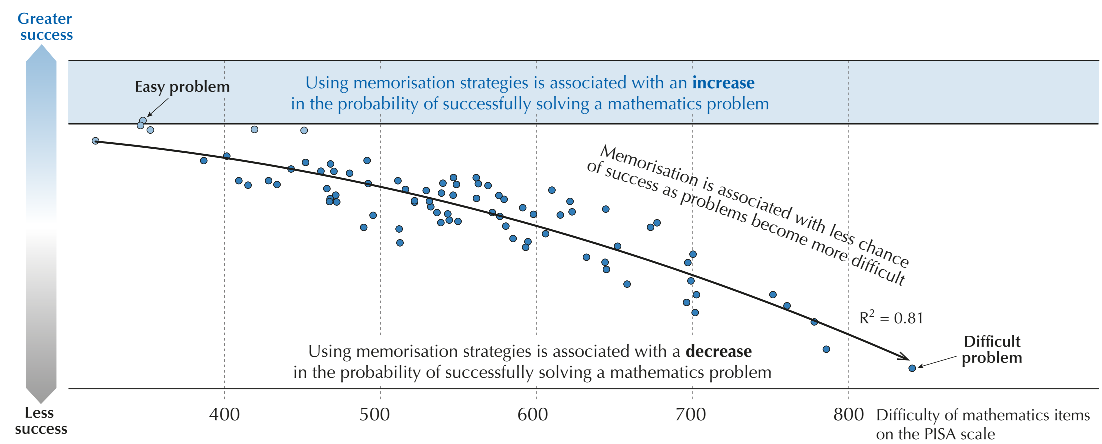


Only 3% of students correctly answered the most difficult question on the 2012 PISA test. Solving this problem required multiple steps and involved substantial geometric reasoning and creativity. An analysis of PISA results shows that students who reported using memorisation the most when they study mathematics (those who chose the memorisation-related statement for all four questions) were four times less likely to solve this difficult problem correctly than students who reported using memorisation the least (Figure 3.11).

Figure 3.11

Memorisation strategies and task difficulty

Odds ratio across 48 education system



Source: OECD (2016), *Ten Questions for Mathematics Teachers… and How PISA Can Help Answer Them,* Figure 4.2, http://dx.doi.org/10.1787/9789264265387-en.

Indeed, PISA results indicate that no matter the level of difficulty of a mathematics problem, students who rely on memorisation alone are never more successful in solving mathematics problems. This would suggest that, in general, teachers should encourage students to go beyond rote memorisation, to think more deeply about what they have learned and to make connections with real-world problems.

But PISA results also show a difference in students' performance based on the types of memorisation activities used. Students who practice repetitive learning (drilling) are more successful in solving difficult problems than those who simply learn something by heart (rote memorisation). Repetitive learning can ease students' anxiety towards mathematics by reducing the subject to a set of simple facts, rules and procedures that might seem less challenging for the least-confident students to master. Drilling can also free up time for more advanced mathematics by gradually reducing the mental effort needed to complete simple tasks.

PISA 2015 looked at this from another angle. It made epistemic beliefs, knowledge and understanding a focus of the PISA science assessment, assessing not just what students knew, for example in the field of science, but also whether they could think like a scientist and how they valued scientific thinking. The rationale behind this was that the more rapidly content knowledge evolves in a subject, the more important it is for students to understand the structural and conceptual foundations of a discipline (know that) rather than just master its content with a limited shelf life or related contextual knowledge (know-how). In the field of mathematics, for example, students need to know how and why we study mathematics (epistemic beliefs), be able to think like a mathematician (epistemic understanding) and grasp the practices associated with mathematics (methodological knowledge).

The results varied strikingly across countries, even within regions. For example, students in Chinese Taipei were among the highest performers on the 2015 science assessment, but in relative terms, they were significantly stronger in reproducing scientific content than in demonstrating scientific thinking. Students in Singapore were stronger than their peers in Chinese Taipei in content knowledge, but they were even better on tasks requiring them to think like a scientist than on content knowledge. Students in Austria were stronger in the knowledge of scientific facts than in understanding scientific concepts, while their French peers were stronger in conceptual knowledge. Such variations even among otherwise similar countries suggest that education policy and practice can make a difference, and it should encourage policy makers and educators to reframe curricula and instructional systems to place greater emphasis on deep conceptual and epistemic understanding.

WHAT DO WE ACTUALLY KNOW ABOUT TEACHERS' PEDAGOGICAL KNOWLEDGE?

The preceding sections provide some indirect reflections of the type of learning going on in classrooms. It is much more difficult to look at teachers' pedagogical knowledge more systematically.

Teachers' specialised knowledge encompasses a range of different fields and types of knowledge. Some of these are common to all teachers (e.g. knowledge of child development or forms of evaluation), while some differ based on the teacher's subject (e.g. knowledge of mathematical concepts, language or history), the age group taught, or the educational context (e.g. knowledge of curriculum). Three categories of teachers' knowledge are often seen as particularly important:

- general pedagogical knowledge (knowledge in creating and facilitating effective teaching and learning environments for all students, independent of subject matter)
- content knowledge (knowledge of subject matter or content area)
- pedagogical content knowledge (knowledge about the teaching and learning of a content area).

A framework for measuring teachers' general pedagogical knowledge

While there are well-established theoretical frameworks on teachers' knowledge, it is surprising how little is actually known about what teachers know and can do. That is true for the OECD as well. Only recently has the OECD begun to develop instruments to assess teachers' knowledge as part of its Innovative Teaching for Effective Learning project, starting with the first of the three above categories, general pedagogical knowledge. A review of empirical evidence on teachers' general pedagogical knowledge identified three components around which the assessment was developed. Each of these dimensions is further specified into two sub-dimensions, as set out in Table 3.1.

Table 3.1

Framework for assessing general pedagogical knowledge of teachers

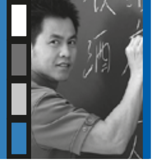
Dimension	Sub-dimension	Description
Instructional process	Teaching methods and lesson planning	Productively utilising instructional time through use of various teaching methods (e.g. direct instruction, discovery learning), knowing when and how to apply each method to promote students' conceptual understanding of learning tasks and structuring learning objectives, lessons, curricular units and assessment
	Classroom management	Maximising instructional time through awareness of all classroom activity, handling multiple classroom events concurrently, pacing lessons appropriately to maintain momentum, providing clear directions and maintaining student attention
Learning process	Learning and development	Fostering individual learning through knowledge of various cognitive learning processes, including learning strategies, impact of prior knowledge, memory and information processing, causal attributions, effects and quality characteristics of praise, and opportunities for increasing student engagement
	Affective-motivational dispositions	Knowledge of motivational learning processes (e.g. achievement motivation) and strategies to motivate a single student or whole group
Assessment	Evaluation and diagnosis procedures	Knowledge of different forms and purposes of formative and summative classroom assessments, and how various frames of reference (e.g. social, individual, criterion-based) impact student motivation and quality of assessment
	Data and research literacy	Knowledge of interpreting, evaluating, and using research and data to inform the teaching and learning process (e.g. relevance, validity, reliability)

Source: Sonmark, K. et al. (2017), "Understanding teachers' pedagogical knowledge: Report on an international pilot study", *OECD Education Working Papers,* No. 159, http://dx.doi.org/10.1787/43332ebd-en.

A first pilot of this assessment has been completed, which involves judgement samples composed of 943 in-service teachers and 644 pre-service teachers from 5 countries: Estonia, Greece, Hungary, Israel and the Slovak Republic (Sonmark et al, 2017). It is important to acknowledge the pilot nature of the exercise, which still needs to be replicated with representative samples before it can be used for policy decisions.

Profiles of teachers' general pedagogical knowledge

The Teacher Knowledge Survey pilot provides some interesting initial insights on the pedagogical knowledge base of teachers, teacher candidates and teacher educators. It does this by visualising the relative strengths and weaknesses of the pedagogical knowledge base as a series of profiles. These visualisations are based on the three dimensions and sub-dimensions of the Assessment Framework set out in Table 3.1.



Teachers, teacher candidates and teacher educators might be expected to possess a strong and balanced knowledge base across these three dimensions, although it is possible that priorities in teacher education systems might skew the profiles in a particular direction. If a balanced knowledge base is expected but the profile shows that there is a particular strength in one dimension, this would give an indication of what elements the system could usefully aim to strengthen. Across the participating countries, the pilot survey identified three distinct types of profiles:

- ***Strength in instruction***
The knowledge base in this profile is strongest on items relating to teaching methods, lesson planning and classroom management. This could be due both to teacher education and practical experience. While teacher candidates with this profile would be expected to possess a more theoretical knowledge of best practices for instruction, in some countries there has been a move towards more practice-oriented teacher education. Teacher education that is driven by a know-how approach is more likely to equip teacher candidates with a strong knowledge of instruction processes. Systems that place an emphasis on mentoring and induction may also tend to prioritise this element. Teacher educators with strength in instruction could benefit from both theoretical and practical knowledge, as well as from their own meta-knowledge and experience of how teachers and teacher candidates develop in their classes and throughout their careers.

- ***Strength in learning***
In this profile, the knowledge base is strongest on items relating to the cognitive, motivational and emotional dispositions of students and their learning processes and development. Strength in this dimension could come from a primarily theory-based teacher education system in which the disciplines of classical developmental psychology (e.g. from Piaget, Vygotsky, etc.) and more recent cognitive sciences (e.g. the brain sciences) dominate.

Teacher candidates from those programmes would have a stronger knowledge base on students' cognitive and emotional development. For teachers, this profile could reflect ongoing professional development that is continuously updated with new evidence from the learning and brain sciences, and/or continuing PhD studies in these areas. It could also reflect informal processes of learning, such as reading specialised magazines. For teacher educators, this profile might reflect those who are actively producing, using and disseminating research in the learning and brain sciences.

- ***Strength in assessment***
In this profile the knowledge base is strongest on items relating to evaluation and diagnostic procedures, as well as data use and research literacy. This could reflect the rise in accountability in education and the increasing emphasis placed on standardised student assessments and various forms of national or regional examinations in many systems.

The survey also asked respondents about their initial training and professional development, as well as their self-reported self-efficacy and instructional quality. Despite reporting similar opportunities to learn about classroom management in initial teacher education and professional development, in-service teachers reported higher levels of self-efficacy than pre-service teachers in all aspects of self-efficacy in classroom management, which is perhaps due to the influence of years of experience (Figure 3.12). This may imply that teachers do not feel fully confident until they gain substantial experience in the profession. The pilot results also show that for pre-service teachers, a practicum in initial teacher education predicts how confident they will be and obtaining early classroom experience may be of particular importance in order for new teachers to be prepared for the job as soon as possible.

The pilot results also suggest a link between confidence and teaching quality among in-service teachers. The more confident they feel about their classroom management skills, the less likely they are to report lots of disruptive noise in the classroom. In-service teachers who feel more confident about teaching are also more likely to report that they know what is happening in the classroom, that they make the rules for classroom behaviour explicit for their students and that their students try to create a pleasant learning environment.

As shown in Figure 3.13, both *teacher candidates* and *teachers* exhibit the most strength in data use and research literacy. These items measured knowledge of statistical concepts, as well as knowledge of interpreting and applying research evidence. Strength in this sub-dimension can partly be related to the specificities of the teacher sample, namely that one-quarter of respondents were mathematics teachers, and approximately one-third science were teachers, while only 19% were mother-tongue language teachers.

Teacher candidates' second strongest area is classroom management.

Teachers' second strongest knowledge domain is evaluation and diagnosis procedures, which, in the assessment, pertained to knowledge of the forms and quality of assessment, assessing collaborative skills, transfer of learning and learning gain, and giving feedback.

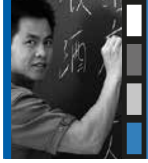
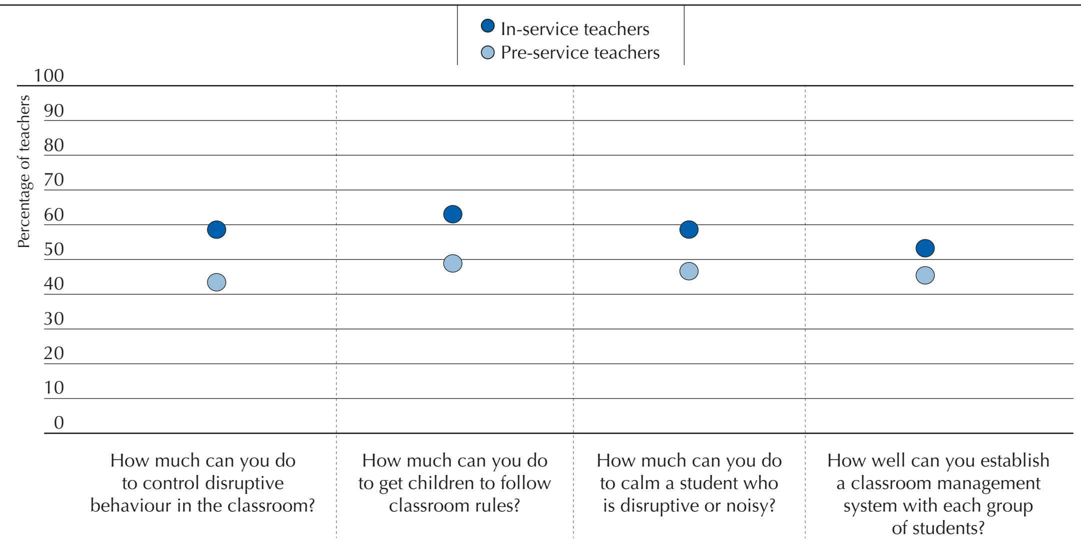


Figure 3.12

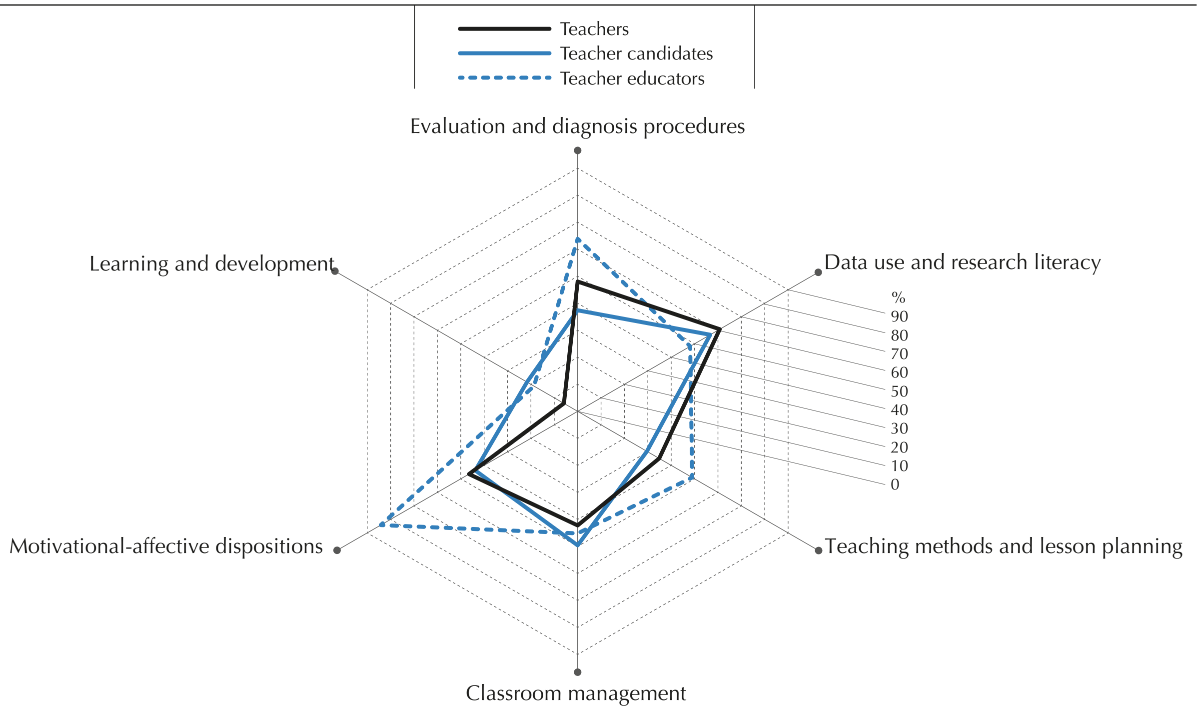
In-service and pre-service teachers' self-efficacy in classroom management



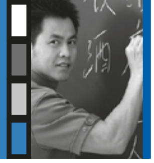
Note: The pilot data are based on judgment samples and show the analytical potential of the instrument. They do not reflect the actual population of countries or sampled groups.
Source: Sonmark, K. et al. (2017), "Understanding teachers' pedagogical knowledge: Report on an international pilot study", *OECD Education Working Papers,* No. 159, http://dx.doi.org/10.1787/43332ebd-en.

Figure 3.13

Profile of teacher candidates, teachers and teacher educators per sub-dimension



Note: The pilot data are based on judgment samples and show the analytical potential of the instrument. They do not reflect the actual population of countries or sampled groups.
Source: Sonmark, K. et al. (2017), "Understanding teachers' pedagogical knowledge: Report on an international pilot study", *OECD Education Working Papers,* No. 159, http://dx.doi.org/10.1787/43332ebd-en.



Teacher educators' profile is strongly skewed towards motivational-affective dispositions, reflecting knowledge pertaining to types of student motivation, goal orientations, mastery and performance. Perhaps surprisingly, data use and research literacy is a relatively weak area of the teacher knowledge base as measured in this assessment.

SHAPING LEARNING ENVIRONMENTS

The previous analysis raises the question of how policy and practice can shape learning environments and pedagogy. OECD Centre for Educational Research and Innovation ran an Innovative Learning Environments project from 2008 to 2017. Part of that work consisted of an in-depth study of some 40 learning environments that have taken the innovation journey (OECD, 2013).

Prior work on the learning sciences (Dumont, Istance and Benavides, 2010) led to seven learning principles that define 21st century effectiveness and together function as an analytical framework for examining innovative learning environments (Box 3.3).

Box 3.3. The learning principles of the Innovative Learning Environments project

1. The learning environment recognises the learners as its core participants, encourages their active engagement and develops in them an understanding of their own activity as learners.
2. The learning environment is founded on the social nature of learning and actively encourages well-organised co-operative learning.
3. The learning professionals within the learning environment are highly attuned to the learners' motivations and the key role of emotions in achievement.
4. The learning environment is acutely sensitive to the individual differences among the learners in it, including their prior knowledge.
5. The learning environment devises programmes that demand hard work and challenge from all without excessive overload.
6. The learning environment operates with clarity of expectations and deploys assessment strategies consistent with these expectations; there is strong emphasis on formative feedback to support learning.
7. The learning environment strongly promotes "horizontal connectedness" across areas of knowledge and subjects as well as to the community and the wider world.

Source: OECD (2017b), *The OECD Handbook for Innovative Learning Environments*, http://dx.doi.org/10.1787/9789264277274-en.

The Innovative Learning Environments project added three more dimensions to the framework:

1. Innovate the "pedagogical core" of the learning environment, whether the core elements (learners, educators, content and learning resources), the dynamics which connect them (pedagogy and formative evaluation, use of time and the organisation of educators and learners) or combinations of both.
2. Become formative organisations with strong learning leadership constantly informed by evidence about the learning achieved through different strategies and innovations.
3. Open up to partnerships by working with families and communities, higher education, cultural institutions, media and businesses, and especially with other schools and learning environments, in ways that directly shape the pedagogical core and the learning leadership.

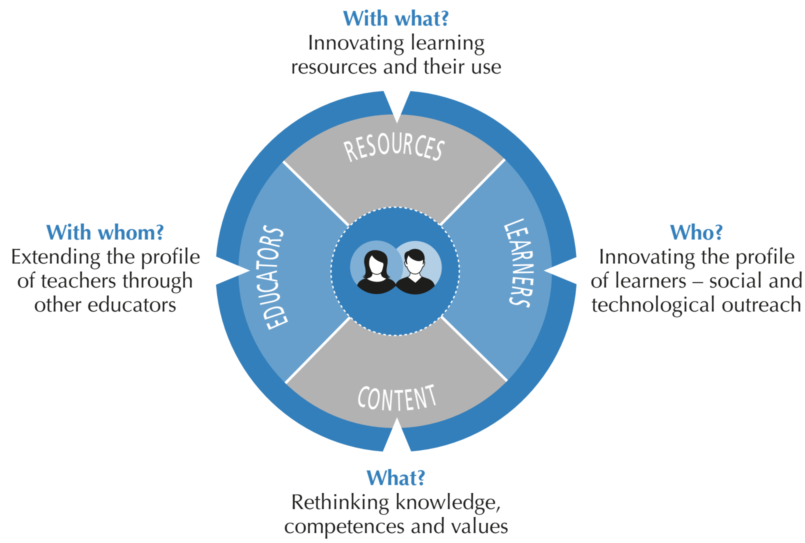
Four main elements comprise the pedagogical core: learners (who?), educators (with whom?), content (what?) and resources (with what?). To rethink and then innovate these core elements – each individually and especially all four together – is to change the heart of any learning environment (Figure 3.14).

Innovating the pedagogical core at the heart of schools means transforming organisational relationships and dynamics to make them relevant for the 21st century. In many cases, this means rethinking the kinds of organisational patterns that are the backbone of most schools today: the lone teacher; the classroom separated from other classrooms, each with its own teacher; the familiar class schedule and bureaucratic units; and the traditional approaches to teaching and classroom organisation.

The case studies described below have systematically rethought many of these practices and have created new learning environments by regrouping teachers, regrouping learners, rescheduling learning, and/or changing pedagogical approaches and the mix of those approaches.

Figure 3.14

Innovating the elements of the pedagogical core



Source: OECD (2017b), *The OECD Handbook for Innovative Learning Environments*, http://dx.doi.org/10.1787/9789264277274-en.

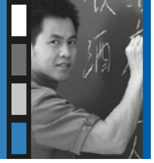
Regrouping educators and teachers

The following case studies highlight three main arguments for abandoning the conventional format of one teacher per group of learners. First, teachers benefit from collaborative planning, working together and shared professional development strategies (i.e. teamwork as an organisational norm). Second, team teaching allows for a wider variety of teaching options. Third, teamwork can benefit certain groups of learners who might otherwise not get the attention they need when only one teacher is in charge.

In some of the cases, collaboration might be described as part of the general culture of the learning organisation:

> Teaching teams are cross-curricular and complementary at Lakes South Morang P-9 School (Victoria, Australia), with team members planning and teaching together, as well as coaching one another. To support this, a collaborative data-storage system is available for sharing documentation, assessments, etc. Experienced team teachers also engage in coaching other teachers on various teaching approaches that cater to different learning styles.
>
> Lobdeburgschule, Jena (Thuringia, Germany): Twenty years ago, teachers introduced teamwork as a structural element. Organisational and pedagogical themes, as well as learning and working practices, are discussed in the teams. In the early 1990s, they established the "morning circle", when all students gather to discuss different aspects of school life.
>
> Teachers in the Quality Learning Center and Enquiry Zone, Mordialloc College (Victoria, Australia) used to "teach to the text", according to the assistant principal, within single, closed-door classrooms. This has changed. Now teachers open up their classrooms and work in teams to model and share good practice – not only with their colleagues, but also with students and the broader community.

The collaborative process of team teaching encourages informal reflection and feedback. When teachers work together regularly, collaboration becomes a tool for recording, learning and sharing good practice. This is in line with the development of professional learning communities for teachers, which collaboratively analyse pedagogy and lesson content in order to continually refine practice.



Professional learning is a priority in the Community Learning Campus, Olds High School (Alberta, Canada). Much of the professional learning is embedded in daily activities, such as team teaching, curriculum building (multidisciplinary teams of teachers working collaboratively to design an integrated, multidisciplinary programme of study), collaborative lesson planning and team meetings. Teachers also attend professional learning days scheduled by the school or the district.

An important aspect in CEIP Andalucía (Seville, Spain) is the collaborative work of both teachers and students. Adults in the school (teachers, families and volunteers) are organised into working groups, commissions, meetings, the Teachers' Assembly, etc. This teamwork culture is also present inside the classroom, where several adults often work together in the same class.

At *Jenaplan-Schule* (Thuringia, Germany), teachers collaborate in regular meetings, such as team conferences with teachers from all classes/grades. In the weekly team meetings, teachers discuss important topics for the forthcoming week and develop the subject matter, materials and methods to be used.

Several of the case studies refer to team teaching, which allows for different approaches by two or more educators working together with a large group of learners. It is worth noting that, in education, small is not always preferable to large. Large groups of students may sometimes be taught together in lecture mode and then broken down into smaller groups for other styles of teaching.

Instead of deploying one teacher in a 30-student classroom, in certain subjects, the Cramlington Learning Village (England, United Kingdom) features 2 teachers for a 60-student class. This adds flexibility to the class schedule and allows teachers to split students into groups in any way that suits their needs, such as for parallel or differentiated instruction. It also allows them to run cross-disciplinary sessions, such as an enquiry facilitated by a science teacher and a media teacher. The result is that teachers across many disciplines can build flexibility at no extra cost. The process of team teaching can also help to model and release the creative energies of collaboration, resulting in new and novel ways of orchestrating learning that are engaging to learners.

In CEIP Andalucía (Seville, Spain), the entire class of students is regularly divided into groups of four or five. The lesson comprises activities that each last 15 or 20 minutes and are accompanied by a teacher or another adult. Once the time devoted to one activity has finished, the adults rotate to another group, so that they spend some time with all the groups at every lesson. Each group carries out a different activity, but the general subject matter of all activities is the same.

Team teaching is used in almost all lessons at *Europäische Volksschule Dr. Leopold Zechner* (Vienna, Austria). Many of these teachers speak the same language as the immigrant students in the classes.

Specific groups of learners who might not get the attention they need in large classes often benefit from team teaching.

Having two teachers in the classroom in *Europaschule* (Linz, Austria) allows for a more personal level of attention. For example, one teacher concentrates on the subject matter and explains tasks, while the special-needs teacher primarily focuses on social issues, supports group-building processes and attends to those who need special attention.

Similarly, in the *Hauptschule* (St. Marein bei Graz, Austria), students are taught in mixed-age classes, including some students with special needs. Instead of streaming students into ability groups, teacher teams apply within-class differentiation, alternating between basic teaching for the whole class and add-on content for highly motivated students or extra support for less-motivated students.

Three to five teachers work with *Dobbantó* (Springboard) students (Hungary) on an ongoing basis; two of them are present together in the classroom 40% of the time. Generally, there are three teachers working with the group in the humanities, natural sciences and a vocational field, with at least one of the three having experience in teaching students with special education needs.

Instead of taking low-achieving students out of the classroom in CEIP Andalucía (Seville, Spain), another teacher joins the class during the two hours each day when flexible groups are organised. As a result, there is less misconduct in classes, and low achievers have improved their academic performance.

When teachers work together in teams, they all learn from each other's techniques and practices because they can finally see those practices (enhanced visibility) – they are no longer hidden behind a closed classroom door. The visibility is enhanced even further when this becomes organisation-wide rather than just individual collaboration among colleagues. While this practice might be unnerving to teachers at first, it is inherent in the nature of innovation to disrupt established habits before the innovation is integrated and becomes accepted in organisational practice.

Teachers at the John Monash Science School (Victoria, Australia) identified the benefits of "knowing what others are doing", and therefore learning from one another, as well as "having a stronger sense of what the students are learning" and the ways in which richer connections could be made between different areas of learning. This was a new way of working for teachers, who are traditionally used to closed-off private areas and personal desks.

The Distance Learning Classroom in Lok Sin Tong Leung Wong Wai Fong Memorial School (Hong Kong, China) gives students the opportunity to learn from their counterparts in different schools and enables teachers to observe lessons and exchange information with their peers who are not physically on site. The Smart Classroom is an advanced technological classroom that allows teachers to use a wide variety of media in their teaching. It also serves as a live link with other partner schools.

Regrouping learners

One of the most common ways in which the innovative learning environments discussed here regroup learners is by mixing older and younger learners together.

There is a variety of reasons offered by the case-study schools for grouping together learners of different ages: as a stimulus to learning, as a way of encouraging diversity and contacts that would otherwise be unlikely to develop, to enable peer teaching, and as a way of reducing bullying and fostering good social relations.

In the Lisbjerg School (Aarhus, Denmark), there are two large groups composed of students whose ages span three years (6-9 year-olds and 10-13 year-olds). The students are also organised into smaller groups of 12, which are also mixed in terms of age. Teaching is differentiated and alternates between working within the bigger and the smaller groups. All students follow an individualised learning path (called "the child's storyline"), and document their work in different portfolios.

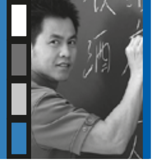
In the Community of Learners Network (British Columbia, Canada), teachers work within the walls of the traditional school structures to create innovative approaches to teaching and learning. For example, in elementary (K-7) classrooms, where students are placed in cohorts based on age, teachers collaborate across grades. They have shifted both the physical structures and the learning structures to enhance collaboration among students of different ages, and they have shifted the power structures to include students as key resources in the education of their peers – and their teachers.

In the Presteheia school (Kristianssand, Norway), learner groups vary in age and size but tend to be between 33 and 54 students. Time in the large mixed groups is used to build relationships among children who would otherwise not socialise. This reduces the incidence of bullying at school and increases feelings of security and confidence. It also makes it easier for students to find someone with whom they can have a trusting relationship, because they can choose among more students. Teachers and other staff are deployed flexibly.

Some of the case studies are very small schools with mixed-grade classes. They intentionally use the heterogeneity of their students as the basis for an individualised education, to encourage integration and autonomous learning.

Gesamtschule Schupberg (Boll, Switzerland) is a small school with a multigrade classroom composed of students of varying cognitive and physical abilities. The school emphasises the heterogeneity of the student group, and regards the heterogeneous student body as a stimulating and motivating influence on the children's social and cognitive development. All 20 students, from Grades 1 to 9 are placed in one mixed-age class. Although students are assigned to a certain grade, learning activities are adapted to their current level of development, allowing for gifted students to be challenged and for weaker students to develop greater self-confidence as learners.

Several of the innovation sites operate with a "house" system that offers a more manageable organisational unit and stimulates more "family-oriented" engagement among students.



Subscribing to the principle that learning is a social endeavour, the Community Learning Campus, Olds High School (Alberta, Canada) is both physically and programmatically organised into four learning communities, called quads. The quads provide a range of learning settings for a wide variety of groupings and configurations of students. The quads bear the names of colours: Red, Green, Blue and Gold. The Red Quad is composed of Grade 9 students. It is the only quad that contains a single grade. The other three quads include a mix of Grade 10, 11 and 12 students. Students remain in the same quad, with the same group of teachers, throughout these three years in high school.

A key part of the collaborative environment in the Australian Science and Mathematics School (South Australia, Australia) is the Tutor Group Programme. Each student is a member of the same multi-year group for the duration of his or her time at the school. The Tutor Group meets daily for 40 minutes. Key roles of the Tutor Group are to "ensure that students feel a sense of belonging within the school" and to "provide care and guidance through strong student-teacher relationships".

At Colegio Karol Cardenal de Cracovia (Santiago, Chile), the unit is not the "house" or "family" or "quad", but the "ministry", as in a national or regional government. In each ministry, there is a student minister, counsellor teacher, parent minister, chiefs of communal departments, mayor of the class and deputy secretary. The "president" is elected during political campaigns that involve voting boxes and election monitors. The student who wins the largest share of votes becomes president of the school government, and the student who wins the next highest number votes becomes the secretary-general to the president.

Co-operative learning is a prominent feature in many of the innovative sites. In some cases, it is more formalised through the establishment of learner groups that are considerably smaller than the houses or tutor groups described above.

In the case of a school in Hong Kong (China), there is a deliberate strategy of mixing abilities in small working groups.

Lok Sin Tong Leung Wong Wai Fong Memorial School (Hong Kong, China) has restructured all classes in primary Grades 1 to 6, dividing students into small groups, normally of around three or four pupils. These heterogeneous groups are formed according to students' academic performance. Each group is made up of both more able and less able students. The heterogeneity of the groups enhances co-operative learning, in which students work together to maximise their own and each other's learning.

Mevo'ot HaNegev Kibbutz Shoval (Israel) operates with a project-based pedagogy, with projects taking place around a specific problem or question that can be theoretical, practical or both. The learners divide into workgroups of three or four students and then examine a topic or a sub-topic from the wider subject.

Rescheduling learning: Innovating how time is used

Schedules structure the school day, week or cycle; the school timetable provides a central organising tool in schools the world over. Many educators still see time primarily in quantitative terms (i.e. as something one has more or less of), with the effectiveness of teaching directly related to it. But with innovative approaches, time is regarded in more qualitative terms.

The distribution and planning of activities over time is a familiar part of school life. A number of the innovative learning environments described here have moved in the direction of organising learning into fewer, longer periods, partly for greater flexibility, but particularly in order to enhance the opportunities for deeper learning.

Mevo`ot HaNegev Kibbutz Shoval (Israel) has a shorter school week (five days) and longer lessons (60 minutes) than are customary in Israel, to allow students to engage more deeply in their lessons. The number of subjects covered per week was reduced from eight to four or five; the relationship between teachers and learners has become more personal; learning has been oriented towards understanding; studying has become more individual and autonomous; and teachers mentor and support the learners.

Every day except Wednesday at John Monash Science School (Victoria, Australia) begins with a 15-minute tutorial group meeting. The timetable of the school operates on a four-period day, and a ten-day cycle. Each period is 75 minutes long to provide, as described by the principal, "opportunities for deep learning".

The timetable at the Community Learning Campus, Olds High School (Alberta, Canada) consists of five 70-minute blocks with 10 minutes between classes. One of the five blocks of time is known as Flex Period (flexible period). Students explained that they have time to eat and also enough time to work on homework or anything else they might wish to work on. They also have access to a teacher during this time.

As some of the schools in the case studies move away from the standard subject-based curriculum, it is not surprising to find that this is reflected in their timetables.

> In Spanish schools, time is organised according to subjects. But in the *Instituto Escuela Jacint Verdaguer*, the timetable is based on methodology instead. The three areas into which the curriculum is organised are reflected in students' timetables and the "learning pyramid": 25% of the time is devoted to instrumental areas, 25% to personal work and autonomy, 40% to co-operative work and the remaining 10% to intrapersonal work.
>
> The academic year lasts 36 weeks in *Dobbantó* (Springboard) (Hungary), as in any other Hungarian vocational school, but the daily and weekly schedules are quite different. Approximately 60% of study time is devoted to general education, and 40% is devoted to developing work-related competencies.

Many of the cases that were studied use time more flexibly than traditional schools. Flexibility goes hand in hand with individualised learning plans and with education philosophies that aim to make schooling less bureaucratic.

> The *Europaschule* (Linz, Austria) has no school bell, since many believe the sound interrupts learning. Teachers start and end their lessons or break a double period when they consider it appropriate.
>
> Instead of the 45-minute rhythm and subject-oriented instruction normally found in the German school system, an open, adaptive form of instruction is applied in the *Jenaplan-Schule* (Thuringia, Germany). Individual students have enough flexibility in their schedules and free time to work and learn at their own pace during the day and to pursue their other interests, apply their creativity and develop their social skills. The goal is to have students understand themselves as active and independent learners who can enjoy the fruits of their efforts.

Some of the innovative learning environments studied provide their students with the opportunity to accelerate their learning. There is international evidence that this leads to improved results.

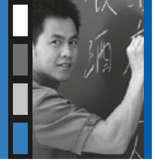
> At the Australian Science and Mathematics School (South Australia, Australia), Year 10 students may study subjects at Year 11 or Year 12 level, while Year 12 students have the opportunity to take first-year courses at Flinders University as part of their Year 12 studies. The school responds to the learning needs of its most motivated and gifted students by allowing them to self-pace their learning and do away with the confines of the traditional school-year cycle.

Rituals can help to structure the school day and make it meaningful, creating routines of reflection or planning. Several of the innovation sites studied begin and conclude the school day or week with such a special moment. For example:

> In the *Projektschule Impuls*, Rorschach (Bern, Switzerland) the day begins with a "morning circle" when a "speakerstone" is passed around and the children can talk about their feelings or thoughts. There is a regular structure to the day. Classes start with a foreign-language session, followed by group work based on learning plans. Afterwards there is a period of absolute quietness, timed by a sandglass that runs for 25 minutes, while the students remain at their place and do not speak or walk around.
>
> The Multimedia Programme, including "The Morning Show", the CGPS Radio Show and Film-Making project, has become central to the Courtenay Gardens Primary School (Victoria, Australia). The show is run each morning by a group of senior school learners who apply to do so and undertake appropriate training. It provides the school community with information about their day ahead, transmitted throughout the school at 9:00 a.m. on the television in each classroom, in the staffroom and at the entrance to the school, from a dedicated multimedia classroom. The show follows a structured storyboard that includes an overview of news around the school, including student and staff birthdays, teachers on yard duty, weather, a "maths minute", phone-ins from classrooms and a film made by students.

A number of the case-study learning environments systematically structure learning and support for their learners outside regular school hours. There are many more examples than those cited below, as all of the sites using virtual e-classrooms, for instance, have removed the close connection between face-to-face contact and organised learning.

> The *Entre Amigos* association in the Polígono Sur (Seville, Spain) is responsible for organising extracurricular activities through an official tender process of the City Council of Seville. From 8:00 a.m., the selected organisations are in charge of the "Morning Classroom", developed to assist those whose parents go to work early in the morning, most of them at street markets. Evening extracurricular activities start at 3:00 p.m. and finish at 5:00 p.m., although CEIP (Spain) is normally open later.



The Lok Sin Tong Leung Wong Wai Fong Memorial School (Hong Kong, China) has launched a number of activities for students before, during and after school. Those who need to be at school early can join the "Reading is Fun" programme, from 7:15 a.m. through most of the following hour. Students can choose different kinds of books to read and share afterwards. In addition to lunchtime activities, students can join the Student Gardener Team to look after the plants in the school garden and the community garden during recess. Every afternoon, students have 40 minutes of self-study to work on their homework. There is also a two-hour period at the end of the school day for tutorial classes on academic and creative subjects.

The Enrichment Programmes, Rodica Primary School (Slovenia) offers an array of artistic, research, international, linguistic and social activities that encourage creative thinking, constructivist education and diverse paths to knowledge. These complement the regular programme and are offered mostly outside of regular lesson time, in the afternoon or on Saturdays.

Widening pedagogical repertoires

Innovative learning environments also work with different pedagogical approaches to expand teaching and learning. Many focus on inquiry approaches and collaborative work, both of which are critical for preparing students for future learning and for equipping students with 21st century skills. These sites also take full advantage of the possibilities afforded by communication technologies. What is important are the mixes of pedagogical approaches. Innovation is not about using a single new teaching method or one kind of technology; it is about employing a combination of tools and approaches, including direct teaching.

In many of the innovative cases studied, students engage in project-based learning. They are encouraged to acquire knowledge while practising skills, like hypothesis generation, scientific inquiry, self-monitoring and (sometimes on line) literary analysis. Some sites have shifted from subject-specific teaching towards more interdisciplinary learning that links knowledge and skills from several subject areas.

The *Jenaplan-Schule* (Thuringia, Germany) distinguishes among learner group instruction (music, arts, sports, handicrafts/woodworking, etc., and social studies), learner group work, and learner group projects in nature, geography/history, German and ethics/religion. In all learner groups, the project work, scheduled for 100 minutes three times a week, is the central working form.

"Problem-Based Learning" is an important part of students' work in natural sciences, social sciences and technology at *Instituto Escuela Jacint Verdaguer* (Spain). All such work is planned as a team and carried out either co-operatively or individually. Understanding a problem is considered to be the first step on the path to finding a solution to the problem. The organisation of learning spaces, the timetable, activities, trips and workshops are based on this methodology.

At Matthew Moss High School, Innovation Unit (England, United Kingdom), student teams work one day per week on a research project. The teachers first introduce a challenge, which can vary from launching an egg as high as possible and returning it to earth without breaking to responding to a natural disaster or investigating family histories of migration. The students then gather information about the topic and write a research proposal which they submit to their teachers for approval. After the proposal is approved, they conduct research throughout the school year. In the process, they are free to organise their own research, while the teachers act as facilitators who present in-time lessons or suggest additional sources of knowledge.

In the Community of Learners Network (British Columbia, Canada), educators design broad inquiry questions that encompass a range of learning intentions. Background knowledge is developed through direct instruction and a series of information-gathering collaborative processes, such as research, "jigsaw puzzles", literature circles, information circles, field experiences and guest presentations. A prominent feature of this phase is a series of "circle meetings" where students' learning is co-constructed and facilitated in small groups. Reflective writing and representations of evolving understanding (using mind maps) follow the small-group meetings. After this phase, the students are coached to articulate their own inquiry questions that fit within the larger inquiry question. As they pursue their individual inquiries, they often facilitate learning experiences for their classmates. Ongoing progress is supported through multilevel feedback circles that rely on self, peer and teacher support. The inquiry process is followed by a celebration of learning, called a Learning Showcase, where families, fellow students and community members are invited to share in the learning experience. Once the inquiry circle is completed, a new one begins, following the same sequencing of activities. This allows the students to become more autonomous in their learning and gradually take on more challenging inquiry projects as they progress.

It is a common feature of many innovative learning environments to make the learning experience authentic and meaningful by engaging students with real-life problems, offering hands-on experiences, and incorporating the students' historical, natural and cultural environment into learning activities. Central to authentic teaching are real-life problems, which are interesting to students because they are more relevant, complex and challenging than simplified problems designed by educators, and because they are more closely linked to the development of 21st-century skills.

> In the Centre for Studies on Design at Monterrey, the Atelier of Ideas, Monterrey (Nuevo León, Mexico), the college co-operates with enterprises and institutions, which submit real-world projects that student teams complete, from brainstorming to final evaluation, with instructors acting as counsellors in this process. There are three major steps: project design (coming up with a plan to bring the project to fruition); collaborative work (working together to optimise the process and the outcomes); and evaluation (by the teacher, peers, the individual student and the external agency that came up with the project proposal).
>
> The three-year practical building and living project at Breidablikk Lower Secondary School (Norway) involves students building houses on a 1:20 scale. Students get to play the role of builder, gardener, electrician, bank employee, real estate agent and others. To this end, the school co-operates with representatives of different businesses. Students use the same digital tools that architects use, and houses are furnished with electricity and handmade furniture. All designs must be environmentally sustainable.

Work on real-life problems often goes together with hands-on experience. At a few sites, hands-on learning involves inviting native speakers of the languages students are learning into the classroom (or through videoconferencing) for face-to-face conversations, or letting students participate in international events where they can hear and speak the languages they are studying.

Hands-on experience may also entail running a small business, such as producing and selling homemade products or working on problems posed by external customers. The students naturally gain experience in such activities as marketing, accounting and customer service, but also in organisation, co-ordination and team work.

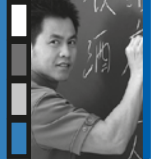
> The Mypolonga Primary School (South Australia, Australia) has a student-organised shop in which the students sell homemade products and products commissioned from the local community to visitors and tourists. All classes are involved in business, craft and tourism, and senior students operate the shop one day per week, along with a junior trainee. Students rotate through a series of tasks in the shop, acquiring language, mathematics, art, craft and hospitality skills along the way.

Authentic learning activities often involve aspects of the students' immediate environment. These allow students to explore the world around them and learn about the cultural and historical heritage of the place where they live.

> *Liikkeelle*! (On the Move!), Heureka, Finnish Science Centre (Finland) encourages students to examine everyday settings from the perspective of natural sciences. Activities include investigating air quality and noise levels with the guidance of relevant experts and authorities. Students place a measuring device near their school, work with a centre for natural-science teaching for analysis, process the data and publish results in an interactive map on an online learning platform. They then discuss the results with students from other schools and with a wide network of experts.

Authentic learning often involves several rounds of review and revision towards a polished result, which may be an exhibition, a stage performance or a portfolio. When students can present their work to a real audience, it becomes a source of public learning and celebration. Working towards a final performance also motivates students to achieve genuine mastery, because real audiences demand coherent presentations and a high level of understanding. Presentations are also learning events in themselves: setting them up involves skills like organising group efforts and communicating effectively with an audience.

> In the Centre for Studies on Design at Monterrey, the Atelier of Ideas, Monterrey (Nuevo León, Mexico), students present the projects they have been working on – all of which respond to real enterprise and community demands – in front of local enterprises and public and/or private institutions. Doing so makes the assessment of their work much more authentic and meaningful to students.
>
> In the Community of Learners Network (British Columbia, Canada), the Showcase is a celebration that completes each inquiry cycle and has come to be seen as an essential element of the learning process. Classmates, school administrators, families and community members are all invited to view the products that the students have created and to discuss their learning experiences with them.



Europäische Volksschule Dr. Leopold Zechner (Austria) practices a special performance assessment called "commented performance portfolio" up to Grade 3. Twice a year students present their achievements to parents and teachers in a detailed conversation that lasts around 30 minutes. Students present work they have done and answer teachers' questions or demonstrate learning by solving problems they feel confident they can tackle in front of their parents.

The orchestration of learning within the environment is complex, involving many decisions, often taken by teachers working collaboratively or with others in the learning leadership, about when and where and with whom particular pedagogies are appropriate, and how these should be modulated over time. In all of the examples below, part of the day involves whole-group, teacher-led activities, mixed in with other types of teaching and learning.

In the Lobdeburgschule (Thuringia, Germany), a typical week for a Grade 1 student starts with the Monday "morning circle", where various topics are discussed. Then, learners work on their individual plans with partners, sometimes with the help of the teacher and using a range of different worksheets and prepared materials for support ("free work"). Then, it is the "epochal projects" session, which is project-based. Students work for about a week on a single theme that includes different subjects and topics of the Thuringian curriculum. At the beginning of the project, the teacher provides core information, questions about the theme are developed, and sometimes small working groups are formed. The results are presented at the end of the week. Subject-oriented lessons follow, but students have more freedom to direct their learning in these lessons. The school week ends with the group "final circle" on Friday afternoon.

At the Mordialloc College (Victoria, Australia), the daily expedition time (11:00 a.m.-1:00 p.m.) provides opportunities for workshops and student conferences related to the substantive curriculum content, as well as embedded aspects of literacy and numeracy. Guides also hold workshops on areas that address the specific needs of students. These are the key points of direct instruction for students and are generally held for groups of 15 or more students.

Coursework at *Jenaplan-Schule* (Thuringia, Germany) includes mandatory subjects, but it also demands a high degree of development and discovery by individual students.

Traditional methods of teaching can be complemented by e-classrooms for acquiring and strengthening knowledge, as well as for assessment (Internet Classroom, Kkofja Loka Primary School, Slovenia). Teachers' learning materials, prepared in advance, are collected in one place within the e-classroom, where they may be used directly without downloading. Instruction via e-classroom takes place through an interactive whiteboard and portable tablets. E-classrooms allow for individual feedback after completed work or activity, with messages or a grade or a knowledge test given before progression to the next level.

Even in learning environments that have deliberately sought to move away from conventional forms of teaching and organisation, there are particular subjects for which those more conventional approaches are judged to be the most suitable even if, in these cases, teachers are always looking to encourage more active engagement among their students. The mix of pedagogies may be realised through the different media and settings used, as when e-classroom work is integrated into the larger menu of teaching and learning options. It may also stem from teachers' preferences and choices as part of the wider orchestration of learning. Again, these innovative learning environments have not simply replaced one approach or methodology with another, but rather use a wide array of approaches, all of which are aligned with the broader learning strategy.

POLICY IMPLICATIONS

When other sectors see flat-lining productivity, they look to innovation. That is happening in education too. Comparisons point to levels of innovation in education that are pretty much in line with those in other sectors. But the central question is perhaps not the volume of innovation, but its relevance and quality and the speed from idea to impact. Innovation is happening, but too little of it is focused at the heart of learning; and when it does focus there, it spreads too slowly.

In many countries, there seems to be a significant gap between what teachers report to be desirable pedagogies and what actually happens in classrooms. Particularly in the English-speaking world, teachers report a preference for constructivist pedagogies, but the results from PISA show learning strategies dominated by memorisation. This is a problem, since memorisation helps students less and less as the tasks on this test become more complex and involve more non-routine analytic skills – which is exactly where digitalisation is driving real-life tasks for humans. In turn, learning strategies framed around elaboration, the capacity of students to connect new knowledge to familiar knowledge, to think divergently and creatively about novel solutions or how knowledge can be transferred are highly predictive for success in the more demanding PISA tasks, but often rare in classroom practice.

However, the significant variation in pedagogical practice across countries suggests that there is considerable scope for policy and practice to shape instructional systems, pedagogical practice and pedagogical beliefs. That variation is also mirrored in initial direct measures on teachers' general pedagogical knowledge that emerge from OECD's first pilot study.

This chapter has made the case for changing the heart of learning environments and has illustrated ways to do so by reshaping the roles of learners, educators, content and resources. Many of these examples provide evidence that the way we think of schools is being reimagined. Teachers and schools are innovating and adopting creative approaches. They are pushing the boundaries of the school out and bringing the community in and rethinking the traditional organisational pattern – where teachers worked alone, each with their own class following a one-size-fits-all schedule and bureaucratic content units.

However, a key question remains. At the system level, how can public policy enable the development and implementation of effective pedagogical practice?

Governance is an obvious lever. Innovative change can be more difficult in hierarchical and bureaucratic power structures that are geared towards rewarding compliance with rules and regulations. One policy approach to foster innovation in schooling has been to increase autonomy, diversity and competition among educational institutions. Questions around autonomy and choice therefore feature high on the policy agenda of many countries. As discussed in the preceding chapter, what seems clear is that choice will only generate the anticipated benefits when the choice is real, relevant and meaningful (i.e. when parents can choose an important aspect of their child's education, such as the pedagogical approaches used to teach them). In the high-performing choice-based systems, private schools also seem to accept public steering and accountability mechanisms that ensure the attainment of public policy objectives in exchange for the funding they receive from the public purse. To reconcile flexibility and innovation with equity, school systems need to carefully devise checks and balances that prevent flexibility from leading to inequity and segregation.

Digitalisation is another policy avenue for enhancing innovation in education. People have quite different views on the role that digital technology can and should play in schools. But we just cannot ignore how digital tools have so fundamentally transformed the world around schools. However, when it comes to technology, education still seems stuck in the age of chalkboards. At the time of the 2012 PISA survey, only around 37% of schools in Europe had high-end equipment and high-speed Internet connectivity, a figure which ranged from 5% in Poland to virtually 100% in Norway. But when asked, between 80% and 90% of school principals said that their schools were adequately equipped when it comes to computers and Internet connectivity, even principals in the many countries where the equipment is clearly substandard. So is technology not that important? Or were school leaders not aware of the potential of ICT to transform learning?

Where digital technologies are used in the classroom, their impact on student performance seems mixed, at best. PISA measured students' digital literacy and the frequency and intensity with which students used computers at school. Students who use computers moderately at school tend to have somewhat better learning outcomes than students who use computers rarely. But students who use computers very frequently at school do a lot worse in most learning outcomes, even after accounting for social background and student demographics (Figure 3.15). Those findings hold for digital literacy skills as well as disciplinary knowledge and skills like mathematics or science.

PISA results also show no appreciable improvements in student achievement in the countries that had invested heavily in digital technology for education. And perhaps the most disappointing finding is that technology has been of little help in bridging the knowledge and skills divide between advantaged and disadvantaged students. Put simply, ensuring that every child attains a baseline level of proficiency in reading and mathematics seems to do more to create equal opportunities in a digital world than is currently achieved by expanding or subsidising access to high-tech devices.

One interpretation of all this is that building deep, conceptual understanding and higher-order thinking requires intensive teacher-student interactions, and technology sometimes distracts from such human engagement. Another is that schools have not yet become good enough at the kind of pedagogies that make the most of technology and adding 21st century technologies to 20th century teaching practices in a 19th century learning environment will just dilute the effectiveness of teaching. Technology can amplify great teaching, but great technology cannot replace poor teaching.

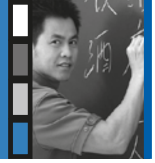
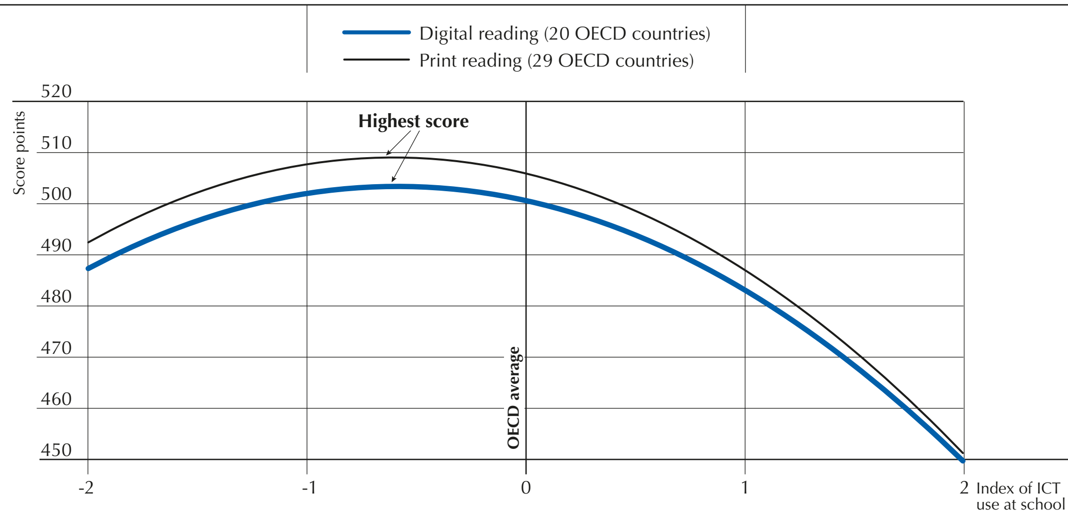


Figure 3.15

Students' skills in reading, by intensity of computer use in school (2012)

OECD average relationship, after accounting for the social background of students and schools



Note: The lines represent the predicted values of the respective outcome variable, at varying levels of the PISA index of ICT use at school.
Source: OECD (2015), *Students, Computers and Learning: Making the Connection,* Figure 6.5, http://dx.doi.org/10.1787/9789264239555-en.
StatLink http://dx.doi.org/10.1787/888933253280

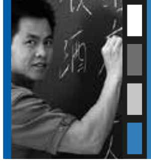
It is unclear why education has not advanced further with making education fit for the digital age. Perhaps it is just that this would disrupt the current business model of governments, academia and textbook publishers. It may also be that the educational industry is too weak and fragmented to take this on. Governments in OECD countries spend more than 9% of health spending on health-related research, while they spend less than 2% of educational spending on educational research. To put it differently, health research budgets in OECD countries are 17 times larger than educational research budgets, and in countries like the United Kingdom or the United States, they are over 70 times larger than educational research budgets. That reveals a lot about the role that we expect knowledge to play in advancing practice.

An even bigger issue is that, even where good educational research and knowledge exists, many educational practitioners just do not believe that the problems they face can be solved by science and research. Too many teachers believe that good teaching is an individual art based on inspiration and talent, not a set of competences you can acquire during your career. Yet, it would be a mistake to just blame teachers for that. This problem goes often back to policy, because there is a real lack of incentives and resources to codify professional knowledge and know-how, and in many countries the room for non-teaching working time is far too limited to support a serious engagement of teachers in knowledge creation. Because education has not been able to build a professional body of practice or even a common scientific language in ways other professions have, practice remains tacit, not articulated, invisible, isolated and difficult to transfer. Investing in better knowledge must become a priority (Box 3.4).

It is also important to create a more level playing field for educational innovation. Without knowing more about the size, market and innovation intensity of the education industry, it will be hard to build a business sector that can generate and disseminate innovation.

Governments can help to put ideas into practice, to strengthen professional autonomy and a collaborative culture where great ideas are refined and shared. Governments can also help with funding and build incentives and signals that strengthen the visibility and demand for what works (Box 3.5).

But governments alone can only do so much. Silicon Valley works because governments created the conditions for innovation, not because governments do the innovation. Similarly, governments cannot do the innovations in the classroom. However, they can help by opening up systems so that there is an innovation-friendly climate where transformative ideas can bloom and they can actively disseminate promising ideas and practice. That means encouraging innovation from teachers within the system and making it open to creative ideas from outside. More of that needs to be happening. Teachers' unions and organisations can play an important role in fostering innovation in practice (Box 3.6).



Box 3.4. Strengthening teacher professionalism and school leadership in Portugal

Portugal has implemented several promising initiatives aimed at strengthening the teaching profession, including the following:

1. implementing more stringent admission conditions for teachers' education programmes (2014)
2. reinforcing scientific curricula in teachers' education programmes (2014)
3. introducing a lifelong training framework for teachers that links continuing professional development to career progression and aims to improve the quality of teaching
4. school clustering and closing small isolated schools to foster greater collaboration among teachers and improve work organisation

In addition, Portugal implemented a reform of its school leadership in 2008, modifying selection processes and responsibilities for principals from first among equals (teachers elected to the position by their peers, functioning mainly as administrators) to professionally selected and accountable school leaders, with clearly identified authority and responsibilities. In 2012, specialised mandatory training for school leaders was also reinforced.

Source: OECD (2014b), *Education Policy Outlook: Portugal*, www.oecd.org/edu/EDUCATION%20POLICY%20OUTLOOK_PORTUGAL_EN.pdf.

Box 3.5. Innovative schools project in Portugal

In 2017, Portugal adopted a national programme for innovation in learning, enabling initiatives, and mobilising schools. This policy, Innovative Schools Project (Escolas Inovadoras), is oriented towards models of enhanced autonomy and combines the goal of Retention 0 (zero) with flexible management instruments (curriculum, spaces, organisation of classes and school calendar). Future Classroom Labs, also known as Innovative Learning Environments, were created as a result of the Innovative Schools Project (with new technology, including computer, tables, interactive white boards and tables, sensors, and graphing calculators to facilitate student learning and teacher training). Teachers are encouraged to apply new teaching methods, project-based and inquire-based learning using these spaces. This project is part of a broader policy approach adopted by Portugal, which includes a new framework of competences for the whole education system (Students' Profile at the End of Compulsory Education), the National Plan for School Success (in place in the majority of public schools and municipalities), specific tutoring to all students who repeat two grades, and the Curriculum Flexibility and Autonomy Programme (currently, in place in 235 schools).

Source: OECD (forthcoming), *Education Policy Outlook 2018: Putting Student Learning at the Centre* [working title], Country Snapshot of Portugal.

Box 3.6. Computing At School

Computing at School (CAS) is a grassroots organisation that supports computer-science teaching in primary and secondary schools, primarily in England but also across the United Kingdom. It offers a good example of the way teachers can organise themselves around innovation and teaching practices. CAS was born out of a serious concern that many students are being turned off computing by the perception that it is dull and pedestrian, so the goal is to put excitement into computing at school. Much of the support provided through CAS focuses on computer-science subject knowledge, but pedagogy also plays a part and arises out of the activity or learning tool being used by the teacher. Main projects include Teach London Computing, and physical computing and programming, using such tools as Scratch and Python. Membership is very broad, including teachers, parents, governors, examination boards, industry, professional societies and universities.

CAS is organised around local hubs, which provide training for other teachers in a given area. The core of the organisation is composed of a strategic alliance with the British Computer Society (The Chartered Institute for IT) and the CAS board. All schools in England are welcome to join the Network of Excellence in computer teaching, which is led by CAS lead schools. These lead schools, along with CAS Regional Centres and CAS Master Teachers, support the implementation of development plans and computing curriculum, provide good practice (such as lesson observations), and run computing-focused transition days. Of special interest are the classroom resources and diverse toolkits and self-assessment frameworks available for teachers.

Source: Computing At School, www.computingatschool.org.uk/.

Policy makers often view education industries as providers of goods and services to schools. They tend to underappreciate that innovation in education is also changing the very environment in which schools operate. In particular, technology-based innovations open up schools to the outside world, both the digital world and the social environment. They also bring new actors into the system, including the education industry, with its own ideas, views and dreams about what a brighter future for education could hold.

Convincing education systems to treat industry as a valuable partner is still a sensitive issue. Fears of a perceived marketisation of education or the displacement of teachers by computers often endanger what could be a fruitful dialogue. It is equally important that governments better understand the education industry.

At the same time, education systems should also be more demanding of the education industry. Most of our children would not voluntarily play with software of the quality that companies are selling to schools. Is innovation in the education industry as dynamic as it should be? Our data about the value of intangibles suggest that less than 10% of the total assets held by the large media groups relate to some form of research and development. Can we break the cartel of a few large suppliers of educational resources who use an army of salespeople to sell their services to a fragmented market? Entrepreneurs cannot afford to play this game. Can we overcome the slow sales cycles, where buyers have to deal with layers and layers of people, all theoretically in charge?

Can we create a business culture for managing innovation in school systems? Currently it is much easier for administrators to buy new tools and systems and use existing staff, because this costs them nothing. The treatment of teacher time as a sunk cost means that people see no benefit to saving this time. It is important to explore how the industry can help the education sector to close the productivity gap, with new tools and new practices, organisations and technology.

To deliver on the promises offered by technology, countries will need much more convincing strategies to build teachers' capacity to use these tools, and policy makers will need to become better at building support for this agenda. Given the uncertainties that accompany all change, educators will often opt to maintain the status quo. To mobilise support for more technology-rich schools, education systems need to become better at communicating the need and building support for change. Investing in capacity development and change-management skills will be critical, and it is vital that teachers become active agents for change, not just in implementing technological innovations, but also in designing them.

Perhaps the most distinguishing feature of technology is not only that it serves individual learners and educators, but also that it can build an ecosystem around learning that is predicated on collaboration. Technology can build communities of learners that make learning more social and more fun, recognising that collaborative learning is a powerful tool to enhance goal orientation, motivation, persistence and the development of effective learning strategies. Similarly, technology can build communities of teachers to share and enrich teaching resources and practices, and also to collaborate on professional growth and the institutionalisation of professional practice. And technology can help system leaders and governments to develop and share best practice around curriculum design, policy and practice.

But the heart of great teaching is not technology, it is ownership. Successful education systems in the 21st century will do whatever it takes to develop ownership of professional practice by the teaching profession.

Productive learning takes place when teachers feel a sense of ownership over their classrooms and when students feel a sense of ownership over their learning. So the answer is to strengthen trust, transparency, professional autonomy and the collaborative culture of the profession, all at the same time.

But the most essential reason why teachers' ownership of the profession is a must-have rather than an optional extra lies in the pace of change in 21st century school systems. Even the most effective attempts to translate a government-established curriculum into classroom practice will drag out over a decade, because it takes so much time to communicate the goals and methods through the different layers of the system and to build them into traditional methods of teacher education. In a fast-changing world, when what and how students need to learn changes so rapidly, such a slow process is no longer good enough. It inevitably leads to a widening gap between what students need to learn and what and how teachers teach.

As the prescriptive approach weakens, the position of classroom practitioners needs strengthening. Governments steer overall directions and curriculum goals, but the teaching profession needs to take greater responsibility for the instructional system, and governments need to find ways to enable and support professionalism.

What this implies, however, is to turn away from idiosyncratic practice (where every teacher has his/her own approach on the grounds of autonomy) towards the common use of practices agreed as effective – in effect, making teaching not just an art but also a science. Finding out what pedagogical approaches work best in what context takes time, deliberate investments in research, and collaborative practice, where good ideas spread and scale in the profession. Achieving that will require a major shift, from an industrial work organisation to a truly professional work organisation for teachers and school leaders. Supporting such a shift is what we should expect from 21st century education policy.

References

Computing At School (n.d.), www.computingatschool.org.uk/.

Dumont, H., D. Istance and **F. Benavides** (eds.) (2010), *The Nature of Learning: Using Research to Inspire Practice*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264086487-en.

Echazarra, A. et al. (2016), "How teachers teach and students learn: Successful strategies for school", *OECD Education Working Papers*, No. 130, OECD Publishing, Paris, http://dx.doi.org/10.1787/5jm29kpt0xxx-en.

Guerriero, S. and **N. Révai** (2017), "Knowledge-based teaching and the evolution of a profession", in *Pedagogical Knowledge and the Changing Nature of the Teaching Profession*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264270695-13-en.

OECD (2013), *Innovative Learning Environments*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264203488-en.

OECD (2014a), *TALIS 2013 Results: An International Perspective on Teaching and Learning*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264196261-en.

OECD (2014b), *Education Policy Outlook: Portugal*, OECD, Paris, www.oecd.org/edu/EDUCATION%20POLICY%20OUTLOOK_PORTUGAL_EN.pdf.

OECD (2015), Students, Computers and Learning: Making the Connection, PISA, OECD Publishing, http://dx.doi.org/10.1787/9789264239555-en.

OECD (2016), *Ten Questions for Mathematics Teachers… and How PISA Can Help Answer Them*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264265387-en.

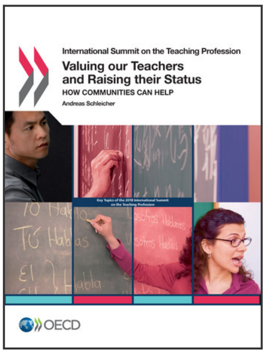
OECD (2017a), "Do new teachers feel prepared for teaching?", *Teaching in Focus*, No. 17, OECD Publishing, Paris, http://dx.doi.org/10.1787/980bf07d-en.

OECD (2017b), *The OECD Handbook for Innovative Learning Environments*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264277274-en.

OECD (forthcoming), *Education Policy Outlook 2018: Putting Student Learning at the Centre* [working title], OECD Publishing, Paris.

Schleicher, A. (forthcoming), *Worldclass: How to Build a Smart School System*, OECD Publishing, Paris

Sonmark, K. et al. (2017), "Understanding teachers' pedagogical knowledge: Report on an international pilot study", *OECD Education Working Papers*, No. 159, OECD Publishing, Paris, http://dx.doi.org/10.1787/43332ebd-en.



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