Unlocking High-Quality Teaching

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Foreword

In the pursuit of advancing educational excellence, the constant improvement of teaching is not just necessary – it's imperative. Amidst the rapid innovations characterising our era, it is tempting to be immediately drawn to new technologies and novel methodologies promising to transform education. Yet, meaningful advancements in educational outcomes can also be achieved by refining practices that have demonstrated impact.

The report aims to deepen the understanding of the complexities involved in refining evidence-backed teaching practices in schools. It does so by exploring the multifaceted nature of teaching – a discipline grounded in scientific research, an art requiring creativity, and a craft necessitating constant collaborative reflection and improvement.

Focusing on 20 practices that support five key dimensions of high-quality teaching, this report draws from extensive research to delineate what we know – and what remains to be understood – about each. While research has shed light into what can effectively improve learning outcomes, applying it in the complex everyday reality of classrooms can be a whole different challenge.

Teachers are tasked with navigating the complexity of the often unpredictable and sometimes chaotic realities of classrooms, where students have diverse needs and abilities, resources are limited, time is constrained, and numerous day-to-day challenges arise. Building upon the expertise from 150 schools across 50 countries, this report offers a rare glimpse into the real-time decisions of teachers and the observations they make in the classroom to gauge their effectiveness.

Teaching, like any science or art, demands craftsmanship. The complexity of teaching requires time and space for continuous learning and reflection, both individually and collectively. Achieving high-quality teaching is not a solitary pursuit; it also depends on the school environment, and the report explores how school leaders can enable high-quality teaching.

This report can be of interest for anyone committed to educational improvement. Incremental gains that enhance student learning might initially seem modest and even negligible, but such gains may accumulate, and ignite real change in our education systems. I hope that this unique report bringing research and practice together can serve as a spark for classrooms around the world.

Acknowledgements

The *Unlocking High Quality Teaching* report from Schools+ is the product of a collaborative and iterative effort involving representatives from policy, research, and practice.

Our gratitude goes to the over 50 participating institutions of the Schools+ Network who spearheaded this report. These include ministries of education, local authorities, teacher and school leadership organisations, large school networks, evidence brokerage organisations, and entities dedicated to educational development such as philanthropic foundations.

Participating institutions nominated schools, which contributed their insights to deepen the understanding of what makes teaching complex. We extend our heartfelt thanks to the teachers and school leaders from over 150 schools across 40 countries who brought their experience with research evidence and innovation and committed to quarterly synchronous and asynchronous knowledge-building activities.

The report has also benefited from the contributions of experts on teaching and learning. An Informal Expert Group (see Annex A), chaired by Jenni Ingram (University of Oxford), provided overarching advice to the work's development and supporting background documents for Chapters 2 to 6. Additionally, 26 experts from academia and knowledge brokerage organisations contributed to the rating exercise and review of scientific evidence on practices. A larger group of an additional 17 academics and organisations provided qualitative input on the conceptualisation of practices and the scoping of their evidence.

The development of this report was guided by Andreas Schleicher and Yuri Belfali, and managed by Anna Pons. The report was authored by Lawrence Houldsworth and Anna Pons, with support from Paula María Rodríguez Sánchez. Noelle Geller was instrumental in overseeing the report's preparation, production, and communications, with Rachel Linden providing additional communications support.

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Finally, we would also like to express our sincere appreciation to all who made this report possible, including the LEGO Foundation and the Jacobs Foundation for their financial support. A full list of contributors is available in Annex B.

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Executive Summary

In an era defined by rapid innovation and constant change, it is tempting to focus on the latest trends or technologies that promise transformative change. However, refining existing teaching practices by closely examining the current realities of classrooms can be a powerful – and even potentially safer – approach to addressing stagnating student achievement, as seen across PISA participating countries. Further understanding the nature of teaching is critical, as no other factor within schools has a greater impact on students' academic success and overall achievement than the quality of teaching.

Unpacking the complexity of teaching

Teaching is inherently complex. Teachers need to navigate the complexity of the often unpredictable and sometimes chaotic realities of classrooms, where students have diverse needs and abilities, resources are limited, time is constrained, and numerous day-to-day challenges arise. They need a deep understanding of both content and pedagogical strategies informed by research, but also adaptability, creativity, and responsiveness. Teaching is a science, but so too an art and craft.

Understanding the fuller complexity of teaching is essential to the ongoing improvement of education systems. This report is grounded in a collaborative, iterative, and multi-stakeholder approach, integrating insights from experts on the best evidence available on high quality teaching and from over 150 schools on how practices are implemented. This work has been further enriched by the 50 countries and organisations participating in the Schools+ Network, representing diverse perspectives across policy, schools and research.

A deep dive into five key teaching goals

The report examines five teaching goals to high quality teaching and 20 practices that teachers draw upon to achieve them. These practices are relevant across different age groups, subjects, educational contexts, and pedagogical beliefs. While teaching is a dynamic whole that goes beyond any single practice, examining each practice separately and in detail allows for deeper insights into the complexity of their implementation.

Ensuring cognitive engagement

Cognitive engagement centres on creating the conditions for students to put forth a sufficient and sustained effort to persist in understanding a complex idea or solving challenging, unstructured problems. To do so, teachers ensure appropriate levels of challenge, embed meaningful context and real-world connections, facilitate first-hand experiences, work with multiple approaches and representations, and nurture students' metacognition. Cognitive engagement can seem enigmatic, as it is difficult to observe. Teachers must carefully consider where students are in their learning alongside the cognitive load of learning opportunities. They accordingly fluidly adapt their role in terms of scaffolding and stretching student

thinking, all the while carefully attending to how they also support students' ability to reflect on and manage their learning.

Crafting quality subject content

Quality subject content focuses on building a deep understanding of subjects – from the subject's core ideas and skills to a critical eye of how to apply these. Teachers ensure quality subject content by crafting explanations and expositions, providing clear, accurate, and coherent contents, making connections, and interrogating the nature of the subject. Its complexity hinges upon understanding, on the one hand, how to look backwards to students' prior learning to build sound, robust understanding that lasts, but also how to look outwards to ensure that connections and patterns in the subject matter are steadily built and enriched.

Providing social-emotional support

Social-emotional support focuses on nurturing a supportive classroom climate and building positive relationships that are conducive to learning. It is also though about furthering students' social-emotional development, with teachers explicitly teaching social-emotional skills and providing opportunities for students to actively practise these skills. An area of rich if relatively recent attention, part of the complexity here lies in the new demands it places on teachers' knowledge of social-emotional skills and how to support their development.

Fostering classroom interaction

Teachers facilitate high-quality interactions in the classroom through questions and responses, organising opportunities for students to collaborate, and whole-class discussions. The complexity for teachers lies in establishing clear routines, balancing teacher and student agency, ensuring an equitable environment of interaction.

Using formative assessment and feedback

Formative assessment and feedback is the ongoing process of teachers carefully evaluating and guiding students' progress through setting learning goals, diagnosing student learning, providing feedback, and adapting to student thinking. Teachers must be attentive to the complex demands of choosing the best timing for different practices and attending to individual needs in large and diverse classrooms, all the while ensuring that students have agency to also steer their learning.

Moving towards more evidence-informed teaching

The practices examined have shown a causal impact on students' cognitive and non-cognitive outcomes. The best available evidence is stronger for classroom interaction and formative assessment practices rather than for cognitive engagement, quality subject content, and social-emotional support – partly because these areas are harder to conceptualise and measure. Further research is needed to understand what works, where, why, for whom, and under what conditions these practices can be most impactful.

A related challenge lies in translating research into classroom practice, which involves not only accessing but also interpreting it and re-evaluating established habits. Greater attention is needed not only on *what* has an impact but also on *how*, fostering a dynamic process where professional experience and scientific knowledge enrich one another.

Empowering high quality teaching in every school

Exploring the complexity of teaching offers valuable insights into ways to improve teaching quality. Some practices – such as ensuring appropriate levels of challenge or facilitating first-hand experiences – are more challenging to implement than others, like setting learning goals. These more challenging practices require opportunities for teacher reflection and thus call for a sustained, tailored approach to their refinement.

But, high quality teaching is not just about the teacher. Factors such as class size, curriculum design, and the wider school climate play a crucial role in shaping what type of practices the teacher can enact in the classroom. The environment can either support or hinder high-quality teaching. School leaders have a critical role in navigating these factors, helping to create conditions that can enable teachers to excel in their craft.

1 Embracing the complexity of teaching

This chapter introduces the need to embrace the complexity of teaching to raise education outcomes, moving beyond pedagogical dichotomies and better understanding how practices that work are actually enacted. It presents five teaching goals for high-quality teaching and 20 practices that teachers can draw upon to achieve them.

In Brief

- Looking into more granular practices can help overcoming pedagogical dichotomies (e.g. progressive/traditional, active/passive) and facilitate a deeper understanding of teaching and its complexity. At the end, teachers need multiple practices that they can choose from that align with the focus and purpose of their teaching.
- This report focuses on five teaching goals and 20 practices that support high-quality teaching:
  - ensuring cognitive engagement
  - crafting quality subject content
  - providing social-emotional support
  - fostering classroom interaction
  - using formative assessment and feedback.
- High-quality teaching requires flexible, context-sensitive decision-making that combines evidence with professional judgement. There is a need to consider more deeply how these elements intersect, considering the 'science' behind effective methods, the 'art' of their implementation, and how teaching 'craft' adapts to varied classroom environments.

The education sector has been shaken in recent years. The forced online shift during COVID-19 brought to the fore essential questions such as the relational nature of teaching and learning. This episode seems now far behind, but emerging challenges have kept these questions relevant, if not even further amplified. These challenges include maintaining student engagement amid distractions from the virtual world, harnessing the potential of generative artificial intelligence (AI), and addressing the anxiety caused by a world marked by increasing economic instability, conflict, and environmental fragility (OECD, 2022[1]; OECD, 2019[2]).

Despite these disruptions, there are times when the education sector appears to be in a standstill. Education performance, as measured by large-scale international studies such as the OECD's Programme for International Student Assessment (PISA), suggest limited improvement in student outcomes in many countries since 2000 (OECD, 2023[3]). Furthermore, PISA also suggests that there has been little progress in terms of equity, with gaps even widening in some contexts.

Do education systems need more innovation or incremental improvements? The trends shaping education bring additional demands and opportunities when it comes to preparing young people for the future. This naturally leads to calls for fresh solutions, which can bring relevant new approaches, ideas and tools to the fore. But, the power of innovation might be overestimated compared to that of incremental improvements. An ever-growing body of evidence has emerged from decades of research on what works in education, signposting ways to enhance teaching through practices with proven impact. These small, targeted improvements hold great potential to accumulate and, ultimately, fuel substantial progress.

This report interrogates the nature and complexity of those small but powerful incremental changes in teaching. It focuses on teaching because it is the most significant determinant of student achievement that can be influenced (Hattie, 2023[4]). It is teachers who prepare students for their lives ahead in ways that enable them to grow and thrive. Much of this impact happens in the classroom, where what teachers do will not only affect what students know (Hanushek and Rivkin, 2010[5]; Rockoff, 2004[6]), but also what skills they master and the values and attitudes they develop (Jackson, 2018[7]). It is thus important to take a

deeper look into teaching, take stock of what we know about high-quality teaching, and embrace the growing complexity of teaching.

This chapter starts by emphasising the importance of moving beyond simplistic teaching dichotomies to embrace the full complexity of teaching. It outlines five broad goals for quality teaching, along with 20 supporting practices that are explored in depth throughout this report. The chapter also underscores the critical role of research evidence in informing teaching practices, while acknowledging that the 'science' of teaching must be balanced with its 'art' and 'craft'. High-quality teaching is a collective endeavour, shaped by the actions of the teacher but also those of the school and system leaders, and professional judgement is considered alongside the school environment.

A deeper look into teaching

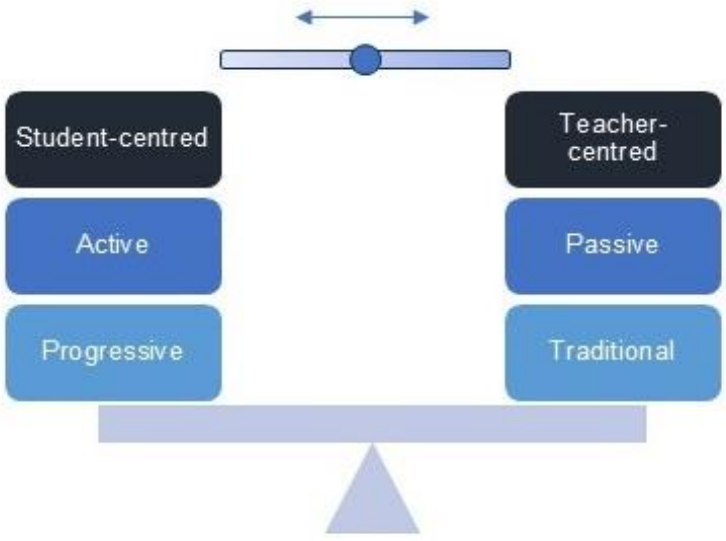
Looking underneath pedagogies

Understanding teaching requires a deeper, more granular examination of current pedagogies. Teaching and pedagogy are two deeply connected terms. At the minimum, pedagogy has been defined as the act of teaching, the relationship between teaching and learning (Loughran, 2013[8]) or “everything a teacher does to help students learn” (Killian, 2019[9]).

Often, however, pedagogy also carries associated values, attitudes and beliefs that influence the acts of teaching (Alexander, 2013[10]). This has, in certain subjects and contexts, led to an increased politicisation of pedagogy (Schön, 1983[11]). In turn, this has seen some pedagogical approaches set in unhelpful dichotomous opposition, often exacerbated with the emergence of new forms of communication and media, as researchers have increasingly come to draw attention to (de Jong et al., 2023[12]; Sweller et al., 2023[13]).

In parallel, new pedagogical approaches, methods and techniques have emerged resulting in an array of new terminologies. Aspects of these respond to new innovative ways of teaching. Others slightly change the conceptualisation of an existing approach. For instance, a scoping of so-called ‘active learning’ pedagogies found that there was a lack of clear definitions of specific pedagogies, with many terminologies used interchangeably (Hood Cattaneo, 2017[14]).

Figure 1.1. Moving from opposition to a complex understanding



Overcoming these dichotomic views of teaching is important to:

- Understand the full nuances of the underlying pedagogical approaches (Schoenfeld, 2004[15]). Approaches can be reduced to a simple 'label', some of which are shown in Figure 1.1, and how they are commonly set in opposition to one another. These labels tend to concentrate emphasis on certain aspects of an approach but fail to capture its entire complexity. In this respect, they push pedagogical approaches artificially further apart, ignoring the way that approaches have been contextualised or qualified, or even envisioned as working alongside other approaches. While labels such as active, inquiry-based, explicit, direct, and so on can help us make sense of distinctions between different pedagogies, they also create differences, and pedagogy is vastly more complex than these dichotomies can convey. An illustrative point can be made with inquiry-based learning, which may be overly simplified to mean a student-centred inquiry process, ignoring the considerable research on the importance of, first, adopting such approaches when there is sufficient mastery from students of key concepts and procedures and, second, sustained teacher guidance, both before and during, in ensuring effective student inquiries (de Jong et al., 2023[12]).
- Promote constructive pedagogical dialogue grounded in evidence. Dichotomous debates can become reductionist and personal, being taken in numerous directions that detract from the question at hand, as evidenced in a range of intra-subject debates such as the 'maths wars' (Schoenfeld, 2004[15]). Dichotomies can also harm teachers' critical engagement with practice and research, leading to distrust and suspicion of different pedagogies irrespective of the evidence available, as well as trust in their own pedagogies irrespective of other evidence (Dinham, 2017[16]). This can also lead to pedagogies based on ideologies and beliefs rather than considering evidence and research, or even pedagogies characterised by rejecting evidence (Kirschner, Hendrick and Heal, 2022[17]). Critique and interrogation are important aspects of the process of advancing knowledge and practice – indeed, some have argued that education, and social sciences research more broadly, may need to hold itself to account more thoroughly (Van Damme, 2022[18]), whilst teachers need the ability to critically examine their teaching in light of changing evidence and adapt to the evolving demands of teaching. Constructive, rigorous dialogue is easier when it is grounded in a shared understanding of these pedagogies and the evidence underpinning them, freed from the rigidity of dichotomies which encourage the idea of a purely 'right' and 'wrong' side to pedagogy.

After all, research does not provide so-called 'silver bullets' of what pedagogical approach is most effective. There is not one single approach that is 'better' than the others. There are too many different goals and needs in education – due to the contextual variation of classrooms, as well as their unpredictable nature – to expect a single approach to work for every single situation. Indeed, there might be mounting or even well-established evidence on what pedagogical approaches might be more effective to teach specific learning goals, such as the teaching of literacy to students in early years and primary school settings (Education Endowment Foundation, 2017[19]; Slavin et al., 2009[20]). Yet this would not comprise an entire pedagogical approach for all educational goals.

Thus, the question is whether these pedagogies are better for what, where, why, for whom, and when. Contrasting progressive with traditional, or active with passive implies there is one approach that is better, distinct from and opposed to the other, that one approach should be adopted while another is rejected. But it is not a case of 'either/or' but rather 'both/and', which can then serve as a platform for interrogating approaches in meaningful ways.

Opening up a wider range of pedagogical choices

Focusing on practices can help to look underneath these pedagogical approaches. Whilst pedagogical approaches can be understood as overarching frameworks, theories or philosophies of teaching, teaching practices, by contrast, are more granular and can be understood as the building blocks of approaches. Practices are the specific tools that teachers draw upon to achieve particular goals in response to the needs of learners. Teachers need multiple practices that they can choose from that align with the focus and purpose of their teaching (Hattie, 2023[4]; Winch, Oancea and Orchard, 2015[21]), reflecting the greater breadth of knowledge, skills, values and attitudes that schools must seek to foster (Schleicher, 2018[22]). Moreover, as the evidence grows for particular practices, so does the nuance around what these practices have an impact on and when.

Looking underneath pedagogies at specific practices can help to highlight the similarities and shared emphasis between different pedagogical approaches, potentially serving as a bridge for the use of certain approaches, perhaps previously not considered or fully understood, for particular goals or contextual needs. This can eventually open up a wider range of pedagogical choices for teachers to draw upon in the classroom.

The differences between pedagogical approaches tend to centre around the role of the teacher and students, and the structure of the activity or task. These differences invite reflection on what a teacher could learn from other approaches and adopt into their practice. For example, might the teacher choose to take a more active role in ensuring appropriate levels of challenge for students in inquiry-based and project-based approaches such as through specific success criteria that make progression clearer? Alternatively, might the teacher when using a direct instruction approach choose to think more actively about how to make use of meaningful contexts or real-world connections that are student-driven when progressing student challenge to the application of knowledge and skills? Teachers may draw from a blend of different pedagogical approaches (Box 1.1).

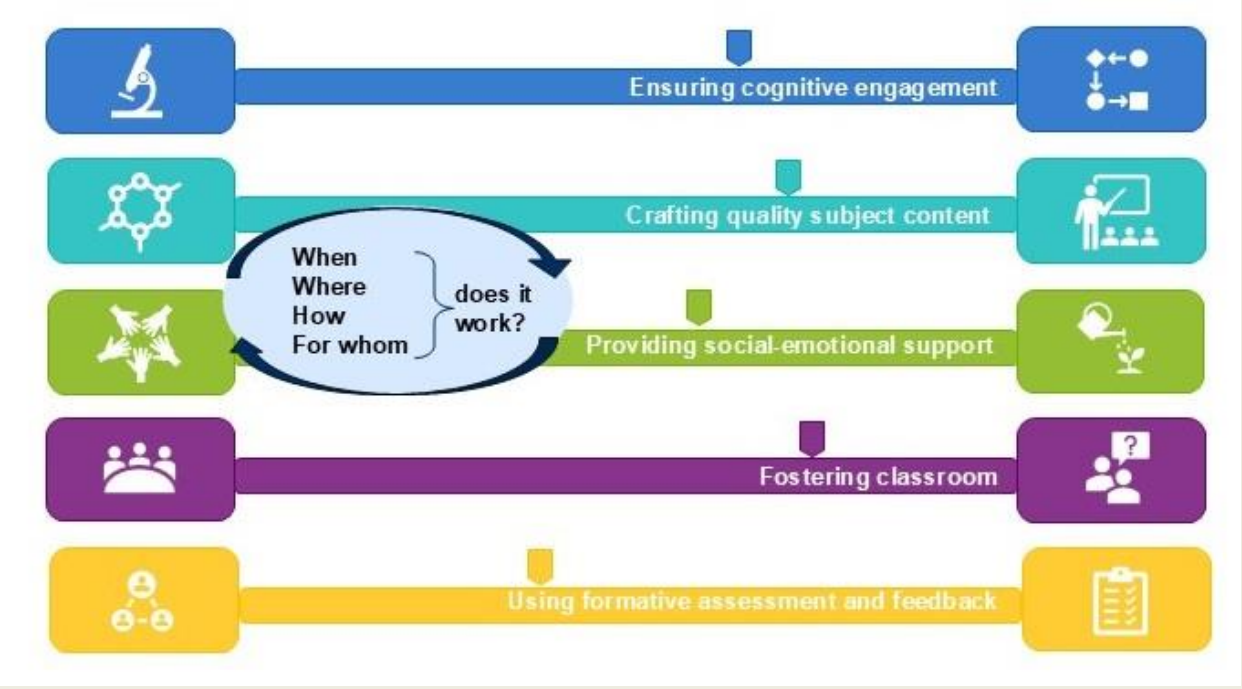
Box 1.1. Why do teachers need to go beyond dichotomies and master a wider repertoire of practices?

Teaching is fluid and dynamic, responding to the needs of what is the immediate goal, when this is happening in the lesson and students' learning journeys, and the particular needs of the student. This may see teachers move between providing more direct, explicit guidance to students and providing them with more space for application, practice and refinement on their own or with each other.

For example, the ability to write paragraphs that balance evidence is an important skill students learn for their analytical thinking and communication. It is relevant whether the evidence in question is data from a science experiment or geography survey, or evidence from primary historical sources or pieces of literature.Teachers may make explanations that specifically model the steps of constructing these paragraphs. They may present sentence starters and key vocabulary, focusing on providing very direct instruction to the whole class. The teacher may ask more specific closed, targeted questions to check on student understanding during this. This may be particularly relevant if students are encountering how to analyse and write about evidence for the first time.

But it may also be that a teacher needs students to practise identifying these features in examples and thinking about how to self-evaluate them. Students may work in small groups to evaluate three example paragraphs and what could improve them. Then, they may turn to co-creating or individually drafting their own paragraphs.

Figure 1.2. Towards a wider repertoire of practices'



When it comes to adopting and implementing practices, there is a constant dialogue around the role of the teacher and the role of students, and how practices are structured. These aren't fixed; if they were fixed, they wouldn't cater to the multiple demands of classrooms today. This is why teachers' professional judgement of when, where, how, and for whom a particular practice might work is critical.

Understanding the building blocks of high-quality teaching

Unpacking teaching

The lack of a shared language in teaching makes breaking down teaching into smaller pieces to further understand what factors are at play challenging (Lortie, 1975[23]; Foray and Hargreaves, 2003[24]). In recent decades, however, researchers have developed various frameworks to facilitate the observation and evaluation of teaching quality (Pianta and Hamre, 2009[25]; Pianta and Hamre, 2009[25]; Praetorius et al., 2018[26]; Taut et al., 2014[27]). By providing a shared terminology and understanding, these frameworks have opened up new opportunities to examine classroom practices in a coherent and detailed way (Grossman and McDonald, 2008[28]; Klette, 2015[29]).

Moreover, empirical studies have tested these frameworks and found general agreement that three broad teaching dimensions – classroom management, social-emotional support, and strategies for engaging and supporting learners – serve as useful perspectives for assessing classroom teaching quality (OECD, 2020[30]). The findings show considerable scope for improvement in practices related to instructional strategies and socio-emotional support, while the potential incremental gains in classroom management practices seem more limited (see Box 1.3).

The report focuses on instructional strategies and socio-emotional support. In particular, the following five teaching goals, dimensions and challenges, towards high-quality teaching are considered:

- Ensuring cognitive engagement, focused on pitching learning at the appropriate level and creating the conditions for students to put forth sustained effort in their work.
- Crafting quality of subject content, focused on building a deep understanding of subjects – from the subject's core ideas and skills to a critical eye of how to apply these.
- Providing social-emotional support, focused on nurturing a supportive classroom climate and building positive relationships that are conducive to learning, whilst also fostering students' social-emotional development.
- Fostering classroom interaction, focused on facilitating high-quality interactions between teachers and students, and among students.
- Using formative assessment and feedback, focused on the ongoing process of teachers carefully evaluating and guiding students' progress.

To achieve these goals, teachers deliberately draw upon specific practices to effectively engage and support all learners to develop desired educational outcomes in the classroom. A total of 20 practices aligned with these goals are analysed in depth to provide a deeper understanding of the complexity of their implementation in the classroom(Figure 1.3). These practices are also reflected in observation frameworks and evidence reviews (see Annex 1.A).

To establish a common understanding of the practices and goals considered, the Schools+ Teaching Taxonomy was developed. This structured framework, featuring clear and precise descriptors, was refined through iterative development across a range of stakeholders. Associated terms for practices were also identified to facilitate a more shared understanding. The Taxonomy is based on the OECD's Global Teaching InSights Observation System, which was created for an innovative video study conducted across eight countries and economies (OECD, 2020[30]). The design principles underlying the Taxonomy are detailed in Box 1.2 and in Annex A – Methodology.

Figure 1.3. The teaching goals and practices examined

Box 1.2. Design principles of the Schools+ Taxonomy of Teaching

- Focus on the underlying practices of different pedagogies: A range of different pedagogies and frameworks of teaching have been examined to identify what practices are the consistent building blocks of teaching. Most of these 20 practices are shared across all of the different pedagogical approaches, cultures, and beliefs interrogated, even if each of them might give different emphasis to each practice.
- Relevancy across grades and subjects: Practices that can be used by any teacher at the primary and secondary levels, regardless of the subject taught. The Taxonomy does not consider what is being taught but how it is taught; in other words, how that subject matter is treated by teachers in the classroom through the core practices.
- Centred on classroom teaching and learning: the teacher's intentional work with students in the classroom, rather than in other learning spaces or at the school level. This includes the activities and approaches teachers plan as well as those that teachers choose to use 'on-the-go' as student learning unfolds. Practices might be led by the teacher, by students, or a blend of both.
- Informed by research evidence: Only practices that have been interrogated through rigorous research methodologies are included. However, the level of impact on student outcomes, as well as the strength of the existing evidence available on each practice, varies considerably.

Many of the practices can be used alongside each other or even simultaneously, within the same lesson or across a sequence of lessons. There are also connections between the dimensions. These connections are essential in reflecting the complex, multidimensional nature of teaching. But, a degree of compartmentalising teaching and focusing on specific practices is needed to turn it into a concrete "object

of study" for either research or teachers' professional growth (Sharples et al., 2019[31]). This is, thus, not intended to narrow discussions around teaching to just these 20 practices in isolation, but rather to provide a starting point for a deeper and richer understanding of practice.

These practices have shown impact on student outcomes

The availability of rigorous research evidence on the impact on student outcomes was a criteria for the selection of the practices examined. However, these practices should not be treated as a set of evidence-based 'silver bullets'; teaching is more complex than a collection of practices drawn from principles of 'effective teaching', 'what works' or 'best practices' can ever fully capture.

The growth in empirical evidence, both in terms of causal studies and studies of teacher effectiveness, has shed new light on effective teaching practices in recent decades. Most of the 20 practices examined have been analysed through randomised or quasi-experimental designs which aim to establish causal relationships and understand what works (Boaz et al., 2019[32]). Moreover, meta-analyses and systematic reviews are also available for some of these practices (Hattie, 2023[4]), which may also offer an indication of the generalisability of certain findings beyond the context of individual studies.

Meanwhile, effectiveness studies, drawing on large-scale student assessments and teacher surveys, have also looked into the relationships between these practices and student outcomes (Le Donné, Fraser and Bousquet, 2016[33]; Kyriakides and Creemers, 2008[34]; Wang and Degol, 2015[35]; Martin, 2013[36]). This research has also been synthesised into a range of reviews and frameworks that seek to capture the patterns across different models of effectiveness (Coe, R. et al., 2014[37]; Muijs and Reynolds, 2010[38]).

The best evidence available for each practice is presented in Chapters 2 to 6. Then, Chapter 7 takes stock of the variation in terms of the extent to which research is available, the strength of the methodologies used, and the range of contexts. Thus, it provides an indication of the extent to which there is a cumulative body of evidence on these teaching practices and the challenges in advancing towards more evidence-informed teaching.

There is potential for incremental gains in how practices are enacted

There has also been a growth in recent decades of research methodologies that use more direct classroom measures. Direct measures can provide a deeper and more complete understanding of how the teaching and learning process unfolds than indirect measures based on questionnaires where teachers and students report on the presence or frequency of different practices. Direct measures can offer an indication on how well the practice is enacted rather than whether it is enacted. However, because of the data collection methods needed, these studies are costly and intrusive meaning few of these studies have occurred at a large and international scale.

The *OECD Global Teaching InSights: A video study of teaching* which was an innovative study designed to capture international variation in teaching and to investigate the relationship between different teaching practices and student learning across a range of contexts and countries (OECD, 2020[30]). To obtain direct evidence from the classroom, about 700 teachers and 17 500 students from eight countries and economies were videotaped in two lessons from the unit of quadratic equations in secondary school Mathematics. The teaching materials were also collected, and both were coded following common and standardised protocols. Before and after the unit, teachers and students filled out questionnaires on their beliefs, practices and perspectives, and students also took tests to measure their learning gains.

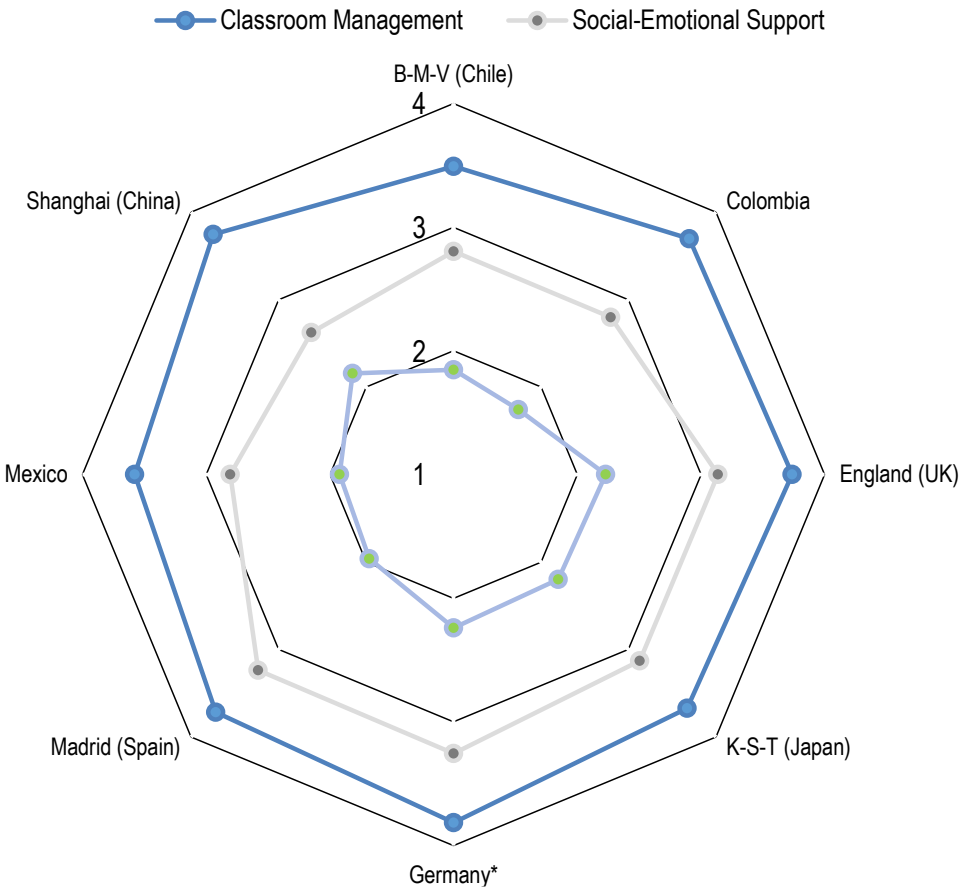
The findings provide an overall picture of teaching quality observed across all participating countries/economies. Within a 1 (low) to 4 (high) observation score, teachers managed the classroom well (mean scores between 3.49 and 3.81), gave students moderate levels of social and emotional support

(mean scores between 2.62 and 3.26), and provided them with reasonable instructional quality (mean scores between 1.74 and 2.24).

The findings suggested that some teachers in every participating country enacted practices in what can be considered a high-quality way, but there is considerable scope for many teachers to further refine how they use certain practices. In particular, the greatest levels of variation across participating teachers were related to instructional practices.

This highlighted the potential value of moving to a more granular understanding and dialogue around the implementation of practices, as well as the need to consider the wider contextual factors that could inform processes of refinement.

Figure 1.4. Scope for potential improvement on teaching quality



Note: The figure shows domain scores based on their components. Components were rated holistically on a four-point scale, ranging from low quality (score 1) to high-quality (score 4) and then averaged over raters, lessons, classrooms and components to the domain level. K-S-T refers to 'Kyoto, Shizuoka, and Tōkyō', and B-M-V refers to 'Biobío, Metropolitana and Valparaíso'. *Germany refers to a convenience sample of volunteer schools.
Source: OECD (2020[30]), Global Teaching InSights: A Video Study of Teaching, https://doi.org/10.1787/20d6f36b-en

Box 1.3. Findings from the Global Teaching Insights Video Study

There was considerable variation in the quality of practices within countries/economies, with no teachers demonstrating a complete mastery of all practices. This points to the considerable opportunities for teachers to share classroom expertise and know-how. Some notable findings of the Study were:

- **Cognitive engagement:** Students had frequent opportunities to develop mathematical fluency through repetitive practice. However, while there were exceptions, teaching materials and classroom interactions did not require students to engage frequently in cognitively demanding activities. Students seldom used multiple approaches to solve problems, articulated the rationale for mathematical procedures and processes, or used technology to enhance their conceptual understanding of the mathematics. For example, students did not use technology during the lessons observed in four out of five classrooms in all countries/economies but Germany* (56%).
- **Assessing and responding to student thinking:** Teachers regularly assessed and responded to students' thinking. During lessons, teachers asked questions that elicited a moderate amount of student thinking. Feedback interactions between students and teachers were brief and focused on the accuracy of answers and procedures. Few teachers (between 2 and 18% per country/economy) provided feedback that was thorough and focused on why students' thinking was correct or incorrect.
- **Classroom discourse:** The detail and depth of classroom discourse varied within and across countries/economies. Students were regularly asked to recall information and state answers, or to summarise and apply rules and procedures. Sometimes students participated in the classroom discourse by contributing detailed thinking. However, with the exception of Shanghai (China) and Kyoto, Shizuoka, and Tōkyō (Japan), lengthier, deeper explanations were observed in less than 25% of lessons.
- **Quality of subject matter:** Students had limited opportunities to connect the mathematics to real-world contexts or to explore patterns in the mathematics. For example, student understanding, handling or application of quadratic equations was sometimes supported by graphs or drawings, but students rarely made connections among the different representations or aspects of the mathematics.
- **Socio-emotional support:** Classrooms were respectful, with few negative interactions such as threats or degrading comments, but nine out of ten classrooms observed were not frequently warm and encouraging. Nearly all teachers surveyed believed that they provided students with support for learning and had a good relationship with them. Most students also agreed, but teachers tended to perceive the social-emotional environment more positively than students. Teachers in most participating countries/economies tended to ignore students' errors or treat them superficially, thus students had fewer opportunities to develop persistence.

Source: OECD (2020[30]), *Global Teaching InSights: A Video Study of Teaching*, https://doi.org/10.1787/20d6f36b-en

The findings of the Global Teaching InSights Video Study are, notably, not isolated and mirrored in other observation studies, in particular in relation to that of instructional support (Klette, 2015[29]). Hence, whilst certain practices such as feedback or metacognition have been the focus of intervention studies and seen a growing body of empirical evidence on their impact on student learning, observation studies repeatedly

find that their presence is limited in day-to-day teaching in many classrooms (Blikstad-Balas, Tengberg and Klette, 2022[39]). In some cases, the foundations of practices can be seen (OECD, 2020[30]); the presence of certain practices but in less impactful formats suggests that it is also not necessarily a case of teaching in a radically different way, but rather moving towards better, more effective implementation of practices.

With the growth of research in education, increasing attention is being placed on making it accessible to schools and systematically studying the types of infrastructure and skills that can support their critical engagement with it (Rickinson et al., 2022[40]; OECD, 2022[41]) (see Chapter 7). However, ensuring that teachers are aware of the impact of these practices is unlikely on its own to be enough for these to be implemented well. It is also important to better understand what makes their implementation complex, and thus teachers' wider professional knowledge and decision-making in the classroom.

The art and craft of teaching

Teaching can be viewed as a science, an art, and a craft. Teaching as a science emphasises the need to use evidence to guide what teachers do in their classrooms and the need to use data and measurement to evaluate the effectiveness of these practices. Teaching is, thus, built upon an evidence base, but it also involves creativity, intuition, flexibility to respond to the host of decisions teachers must make on a daily basis (Jackson, 1990[42]; Clough, Berg and Olson, 2008[43]). Teaching is not perfectly prescribed nor uniform. Moreover, like many crafts, teaching also develops over time; experience and reflection, coupled with feedback and discussion among colleagues, lead to a refinement in how teachers' use professional judgement to implement pedagogies effectively (Sherin and Van Es, 2009[44]; Darling-Hammond, Hyler and Gardner, 2017[45]). Each of these views emphasises different aspects of teaching, but it is the combination of the three views that illustrates the fuller complexity of what teachers do (Winch, Oancea and Orchard, 2015[21]; Schön, 1983[11]; Brown and McIntyre, 1993[46]).

Teaching is complex

Teaching is more complex than what it might seem. Researchers categorise problems as simple, complicated, or complex (Snyder, 2013[47]; Glouberman and Zimmerman, 2002[48]). Simple problems are like following a recipe. Complicated problems involve successfully enacting multiple challenging procedures; but, once mastered, these challenging procedures can be repeated. Complex problems, on the other hand, require new solutions each time.

One aspect that the complexity of teaching hinges upon is its unpredictable nature due to its highly relational nature. After all, teaching centres on the interactions between teachers and students and among students themselves. These are highly variable and thus hard to concretely predict and prepare for (Rowan and Correnti, 2009[49]; Schweig, Kaufman and Opfer, 2020[50]). Moreover, the interactions lead to emergent behaviours, such as real-time progress or student needs, which, in turn, influence the process of teaching. Teaching is very dynamic. Thus, whilst teaching may rely on a degree of routines and norms to make the cognitive load of this complexity more manageable (e.g. norms for interacting, routines for transitions), teaching cannot be reduced to a series of steps. Some decisions can be planned for, but others arise in the moment. Similarly, some decisions will be conscious and deliberate; some will be informed by similar decisions made before, and some will be more instinctive.

A second aspect that defines the complexity of teaching is that it is highly contextual (see Chapter 8). Teaching is shaped by the resources available, curricula and assessments, as well as national or system-level policies and school-level policies and practices, including the school culture. Furthermore, as alluded to, it is also shaped by the students in the classroom, but not only their immediate behaviours and interactions; students' wider individual needs, variations in their existing knowledge, skills and prior

learning, and the collective culture of how they work and interact together are contextual factors that also shape teaching. This means that teaching is characterised not only by a large amount of decision-making, but complex decision-making (Clough, Berg and Olson, 2008[43]; Jackson, 1990[42]). Teachers' decision-making hinges upon range of sources of information, from their immediate knowledge of students to that of the content at hand (Guerriero, 2017[51]; Seidel et al., 2011[52]; Winch, Oancea and Orchard, 2015[21]), which teachers must draw upon and balance to make real-time decisions that can drive students' learning forward.

Understanding not just what works but how it works

There is a degree of professional judgement that shapes the implementation of teaching (Sharples, 2013[53]). Even with the most well-researched practices, it is not possible to absolutely and fully prescribe what must be done in every situation that teachers encounter. Teachers make many decisions in the classroom and only a few can be informed by evidence. Research evidence can enhance teachers' knowledge, but it can never replace their experience or the unique understanding they have of their students and school environment (Nelson and Campbell, 2017[54]; Education Endowment Foundation, 2018[55]).

The feedback to be provided to students is a case in point on the importance of teachers' professional knowledge. Research has shown that feedback can be very impactful (Wiliam et al., 2004[56]; Education Endowment Foundation, 2018[55]; Webb et al., 2021[57]), but also detrimental if implemented incorrectly (Kluger and DeNisi, 1996[58]; Wiliam, 2011[59]). A large body of high-quality research has suggested how feedback should be focused on a specific learning opportunity, offer appropriate scaffolds and challenges to bridge where learners are and need to be, and be coupled with students acting upon this feedback (Elliot et al., 2020[60]).

However, it is the teacher in the classroom that must decide which moment is appropriate for providing feedback depending on how learning is progressing, and what is the most suitable guidance that will serve as a bridge for students' learning of the target content. This is not a pure science, but also the 'art' of teaching. To improve teaching practices, it is thus paramount not just to understand 'what works' but also 'how it works' by codifying to the extent possible this wider professional knowledge.

Codifying the 'art' and 'craft' of teaching

Teachers draw upon their 'art' – their wider professional knowledge – alongside the scientific evidence on teaching to effectively implement high-quality teaching. This wider professional knowledge can be seen as a more tacit type of knowledge, encompassing the intuitive, often unarticulated expertise and insights that teachers develop through experience (Ulferts, 2019[61]). It is a dynamic and evolving knowledge base (Révai and Guerriero, 2017[62]), as it is grounded in their own experiences, both positive and negative, in classrooms, as well as wider interactions with students and colleagues.

The 'art' of effectively implementing practices has been greatly overlooked in research. The effective implementation of practices largely remains tacit knowledge because efforts to move towards greater systematic approaches to understanding and capturing it are still nascent. It is only more recently that aspects such as 'process guidance' have started to be given more attention (Cartwright, 2013[63]).

Similarly, approaches that are more orientated towards eliciting teachers' perspectives and experiences, such as through participatory research and professional learning communities that may draw out professional expertise (OECD, 2023[64]; Stoll, 2015[65]), are rarely considered generalisable. There are, thus, few efforts to codify and synthesise this type of expertise, despite the proliferation in terms of numbers of such approaches and initiatives with schools (Patfield, Gore and Harris, 2022[66]).

Some aspects of the implementation process of practices that can be codified are the key teaching decisions (Zhai, 2019[67]; Grossman, Hammerness and McDonald, 2009[68]; Glisan and Donato, 2017[69]) and the signals from students that result from these practices (Santagata and Guarino, 2010[70]; Chung and van Es, 2013[71]). Chapters 2 through 6 provide insight on these decisions and signals, not to draw an exhaustive list, but to scope out the complexity of implementing practices.

The key teaching decisions (also referred to as critical components, mechanisms of change or active ingredients) are elements of a teaching intervention that have been proven effective and should not be altered during implementation (Harn, Parisi and Stoolmiller, 2013[72]; Stains and Vickrey, 2017[73]). These can be structural (e.g. materials, timing, or frequency of intervention activities) or process-based (e.g. instructional activities, teacher behaviours or student behaviours), depending on the specific teaching practice in question (Stains and Vickrey, 2017[73]).

Students furnish teachers with valuable real-time information that can inform the implementation process and allow for its refinement (Yeh and Santagata, 2014[74]). Research into how teachers observe and analyse practice, for instance, has demonstrated that teachers are attuned to the signals that they receive in the classroom as students' behaviours respond dynamically to teachers' decisions (Rosaen et al., 2010[75]; Star and Strickland, 2007[76]; Blomberg et al., 2013[77]). After all, teachers use practices for a specific purpose which is, overall, part of supporting students' progress in terms of their acquisition and development of specific knowledge, skills and values and attitudes. that students share are therefore a manifestation of this progress.

Finally, teaching is not solely influenced by the teacher; the school environment also plays a significant role in shaping what happens inside the classroom (see Chapter 8). This influence can come from various sources, such as classroom spaces, teaching tools or aids, the distribution of teaching staff, the collaborative norms among staff, and the broader school ethos. The school principal and the leadership team play a major role in shaping the school environment, but also does the wider system, as well as its local community and – particularly in an increasingly digital age – the wider education community too.

Supporting high-quality teaching in every school

The overall aim of this report is to advance the understanding of the complexity of high-quality teaching. It provides an in-depth examination of the five teaching goals and 20 practices that support high-quality teaching across ages, subjects and contexts. For each of them, the report has sought to:

- Identify the best research evidence available for those practices, and provide an indication of the respective areas of strength and limitation.
- Leverage the professional knowledge of teachers and school leaders to make key decisions and observe student responses when implementing these practices, thereby deepening understanding of their complexities.
- Explore the interplay between scientific and professional knowledge, and how school and system leaders can support teachers in refining these practices and fostering environments that promote high-quality teaching.

The methodological approach was characterised by multi-stakeholder collaboration and iterative development (see Annex A and B). It has pioneered integrating scientific research with synthesized professional knowledge. The data was sourced from:

- Over 50 participating institutions in the Schools+ Network, such as ministries of education, local authorities, teacher and school leader organisations, large school networks, evidence brokerage organisations, and entities supporting educational development like philanthropic foundations and international organisations.

- Teachers and school leaders from over 150 schools from 40 countries, chosen by Schools+ participants for their experience with research evidence and interest in innovation. They have participated in quarterly synchronous and asynchronous knowledge-sharing and synthesizing activities to develop these rich qualitative insights on the implementation process of teaching.
- 26 experts from academia and knowledge brokerage organisations that contributed to the rating exercise and review of scientific evidence on practices. An additional 17 academics and organisations provided qualitative input on the conceptualisation of practices and the scoping of their evidence. Their contributions built on background documents developed by the Informal Expert Group of the Project.

It is worth noting that this report focuses on the practices as individual tools that teachers may draw upon in their teaching to particular goals. It does not consider the sequencing of these practices and research from fields such as the science of learning of when certain practices may be most effective in students' learning journey or for which types of learners, nor does it consider in detail the connections between practices and how they may be used in combination with each other. Yet, these are important considerations for teachers and leaders. Instances where particular caution may be exercised, such as in relation to students' prior knowledge, are flagged where appropriate in the discussion of a practice's implementation.

The rest of this report is structured as follows:

- Chapters 2 to 6: Provide an in-depth examination of the 20 practices that can support five teaching goals. Each practice is presented in a consistent, granular way, that outlines both the best available research evidence as well as insights from schools on key teaching decisions and observed effects on students. The final section looks outwards to the types of environmental factors that may enable or hinder effective implementation.
- Chapter 7: Outlines some of the high-level trends that have characterised the pursuit of more rigorous scientific knowledge on teaching in recent years. It presents the strength of evidence for each practice examined in this report, and some of the notable challenges that may shape research agendas going forward when it comes to fostering more evidence-informed teaching. In particular, it emphasises the need to better understand how practices are implemented, as well as their interplay with teachers' professional knowledge.
- Chapter 8: Unpacks the complexity of teaching by considering both the different difficulties that practices present and the degree that a practice's implementation is shaped by environmental factors. It then turns to consider ways in which schools can empower high-quality teaching by supporting teachers to grow their practice as well as providing a more supportive environment.

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Annex 1.A. Mapping of the sub-dimensions of the Schools+ Taxonomy to some other leading frameworks

Annex Table 1.A.1. Emphasis of different pedagogies

		Competency-based learning	Dialogic teaching	Direct instruction	Explicit instruction	Experiential learning	Inquiry-based learning	Gamification	Learning through play	Mastery learning	Problem-based learning	Project-based learning
Cognitive engagement	Ensuring an appropriate level of challenge											
	Metacognition											
	Working with multiple approaches and representations											
	Facilitating first-hand experiences											
	Meaningful context and real-world connections											
Social-emotional support	Nurturing a supportive classroom climate											
	Building relationships (student-student)											
	Building relationships											

		Competency-based learning	Dialogic teaching	Direct instruction	Explicit instruction	Experiential learning	Inquiry-based learning	Gamification	Learning through play	Mastery learning	Problem-based learning	Project-based learning
	(teacher-student)											
	Explicitly teaching and actively practising social-emotional skills											
Classroom interaction	Student collaboration											
	Whole-class discussion											
	Questioning and responding											
Formative assessment & feedback	Learning goals											
	Diagnosing student learning											
	Feedback											
	Adapting to student thinking											
Quality subject content	Crafting explanations and expositions											
	Nature of the subject											
	Making connections											
	Clarity, accuracy and coherence											

Note: Shaded areas represent which fundamental practices were identified by poster speakers at the Schools+ Third Community Meeting as being key features of this pedagogical approach. However, Mastery learning, Dialogic teaching, and Direct instruction have been shaded based on analysis of the literature.

Annex Table 1.A.2. Mapping of the Schools+ Taxonomy's Sub-Dimensions to other dimensions in leading frameworks

Observation frameworks									Evidence reviews and syntheses					
Teaching goals	**Practice**	**TALIS Video Study / Global Teaching Insights)** (OECD, 2020[30])	**CLASS** (Hamre and Pianta, 2007[83])	**Framework for Teaching** (Danielson, 2007[78])	**Mathematical Quality Instruction (MQI)** (Hill et al., 2008[85])	**PLATO** (Grossman et al., 2013[79])	**TEACH Primary** (Molina et al., 2022[87]))	**UTeach Teacher Observation Protocol (UTOP)** (Walkington et al., 2012[80])	**Dynamic model of educational effectiveness** (Creemers and Kyriakides, 2013[81])	**Great Teaching Toolkit** (Coe et al., 2020[82])	**High Leverage Practices** (University of Michigan, n.d.[83])	**Principles of Instruction** (Rosenhine, 2012[84])	**Teaching and Learning Toolkit** (Education Endowment Foundation, 2020[85])	**Visible Learning** (Hattie, 2023[4])
Ensuring cognitive engagement	**Ensuring appropriate levels of challenge**	Engagement in cognitively demanding subject matter	Concept development (analysis/reasoning, creativity)	Engaging students in learning: Activities and assignments, Structure and pacing, Instructional materials and resources		Intellectual challenge	Critical thinking: Provide thinking tasks	Classroom Engagement: (encouraged students to generate ideas, questions, conjectures, and/or propositions)		Structuring: scaffolding and supporting to make tasks accessible to all, but gradually removed so that all students succeed at the required level		Present new material in small steps with student practice after each step	Mastery learning	Cognitive task analysis
			Language modelling (repetition/extension)					Lesson importance (more than exam techniques)		Activating: progressing appropriately from structured to more independent learning as students develop knowledge and expertise		Provide scaffolds for difficult tasks		Working memory

Observation frameworks								Evidence reviews and syntheses					
									Explaining: modelling/ demonstrating new skills or procedures with appropriate scaffolding and challenge				
Metacognition	Metacognition					Perseverance: Encourage goal-setting		Teaching modelling: Encouraging student use of problem-solving strategies	Activating: helping students to plan, regulate and monitor their own learning			Metacognition and self-regulation	Self-regulation strategies Meta-cognitive strategies
Working with multiple approaches and representations	Multiple approaches to/perspectives on reasoning Type of representation	Concept development (integration)		Richness of the mathematics (e.g. use of multiple representations)	Representation of content	Lesson facilitation: Content explained with multiple forms	Content abstraction (multiple forms of representation)		Embedding: giving students tasks that embed and reinforce learning				
Facilitating first-hand experiences	Real-world connections					Autonomy: Opportunities to take on roles and make choices	Lesson investigation (inclusion of investigative or problem-based parts)						Service learning
Meaningful context and real-world connections	Real-world connections				Connections to personal and cultural experiences		Content societal impact (e.g. role in history, current events)					Instructional learning formats (promotion of	

		Observation frameworks							Evidence reviews and syntheses					
						Representation of content		Content significance (examples and activities chosen)					student interests)	
		TALIS Video Study / Global Teaching Insights (OECD, 2020[30])	**CLASS** (Hamre and Pianta, 2007[86])	**Framework for Teaching** (Danielson, 2007[78])	**Mathematical Quality Instruction (MQI)** (Hill et al., 2008[87])	**PLATO** (Grossman et al., 2013[79])	**TEACH Primary** (Molina et al., 2022[87])	**UTeach Teacher Observation Protocol (UTOP)** (Walkington et al., 2012[80])	**Dynamic model of educational effectiveness** (Creemers and Kyriakides, 2013[89])	**Great Teaching Toolkit** (Coe et al., 2020[82])	**High Leverage Practices** (University of Michigan, n.d.[83])	**Principles of Instruction** (Rosenhine, 2012[84])	**Teaching and Learning Toolkit** (Education Endowment Foundation, 2020[93])	**Visible Learning** (Hattie, 2023[4])
Crafting quality subject content	**Crafting explanations and expositions**	Explanations		Communicating with students: Explanations of content	Richness of mathematics (e.g. explicitness of certain mathematical practices)	Modelling	Lesson facilitation: Models by enacting thinking aloud		Teaching modelling: Promoting the idea of modelling, inviting students to develop strategies	Explaining: presenting and communicating new ideas clearly, with concise, appropriate, engaging explanations	Explaining and modelling content	Guide student practice		Direct instruction
		Understanding of subject matter procedures and processes		Communicating with students: Directions and procedures	Mathematical language (e.g. density of accurate language in instruction)					Explaining: modelling/demonstrating new skills or procedures with appropriate scaffolding and challenge		Provide models		Problem-solving teaching
														Worked examples
	Nature of the subject					Purpose		Content societal impact (e.g. role in history, current events)						

Observation frameworks								Evidence reviews and syntheses					
Making connections	Explicit connections			Connecting classroom practice to mathematics (e.g. connected to important, worthwhile mathematical ideas and procedures)	Connections to prior knowledge Representati-on of content	Lesson facilitation: Relate to other content	Implementation connection (connecting to prior knowledge and experiences)	Application: Using application tasks for next learning points	Explaining: connecting new ideas to what has previously been learnt (and re-activating/checking that prior knowledge)				Concept mapping
	Explicit patterns and generalisations						Content interconnections		Explaining: using examples (and non-examples) appropriately to help learners understand and build connections				
							Content abstraction (models and systems)						
Clarity, accuracy and coherence	Clarity	Instructional learning formats (clarity)		Mathematics errors (e.g. presence of)			Content accuracy	Structuring: Drawing attention to and reviewing main ideas	Embedding: requiring students to practise until learning is fluent and secure	Designing single lessons and sequences of lessons	Begin a lesson with a short review of previous learning	Mastery learning	Summarisation
	Accuracy						Lesson sequence (well-organised and structured)						

Observation frameworks									Evidence reviews and syntheses					
		Repetitive use opportunities	Language modelling (repetition/extension)		Responding to students inappropriately (e.g. misinterprets or failure to respond)			Content significance (alignment to standards)	Structuring: Outlining the content and signalling transitions	Embedding: ensuring that once-learnt material is reviewed/revisited to prevent forgetting		Engage students in weekly and monthly review		Teacher clarity
		Summary						Content fluency (consistent with deep knowledge)						
		TALIS Video Study / Global Teaching Insights (OECD, 2020[30])	**CLASS** (Hamre and Pianta, 2007[86])	**Framework for Teaching** (Danielson, 2007[78])	**Mathematical Quality Instruction (MQI)** (Hill et al., 2008[87])	**PLATO** (Grossman et al., 2013[79])	**TEACH Primary** (Molina et al., 2022[87])	**UTeach Teacher Observation Protocol (UTOP)** (Walkington et al., 2012[80])	**Dynamic model of educational effectiveness** (Creemers and Kyriakides, 2013[81])	**Great Teaching Toolkit** (Coe et al., 2020[82])	**High Leverage Practices** (University of Michigan, n.d.[83])	**Principles of Instruction** (Rosenhine, 2012[84])	**Teaching and Learning Toolkit** (Education Endowment Foundation, 2020[85])	**Visible Learning** (Hattie, 2023[4])
Providing social-emotional support	**Nurturing a supportive climate**	Risk-taking	Positive climate (communication, respect)				Supportive learning environment: Use of positive language with students		The classroom as a learning environment: Dealing with disorder and student competition (rules, respect)	Establishing a culture for learning: Expectations for learning achievement, Student price in work, Importance of content	Establishing and maintaining community expectations			
			Sensitivity (awareness, responsiveness, comfort)				Supportive learning environment: No exhibition of bias, stereotypes challenged							

Observation frameworks								Evidence reviews and syntheses					
						Perseverance: Acknowledge students efforts							
Relationship building (teacher-student)	Respect	Positive climate (relationships)	Creating an environment of respect and rapport: Teacher interaction with students			Supportive learning environment: Treats all students respectfully			Promoting interactions and relationships with all students that are based on mutual respect, care, empathy and warmth; avoiding negative emotions in interactions with students; being sensitive to the individual needs, emotions, culture and beliefs of students	Building respectful relationships			Teacher-student relationships

		Observation frameworks							Evidence reviews and syntheses					
	Relationship building (student-student)	Respect		Creating an environment of respect and rapport: Student interaction with students			Social and collaborative skills: Promote students' interpersonal skills	Implementation involvement (attending to student-student interaction)		Promoting a positive climate of student-student relationships, characterised by respect, trust, cooperation and care	Building respectful relationships		Social-emotional learning (pupils' decision-making skills, interaction with others and their self-management of emotions)	
	Explicitly teaching, actively practising social-emotional skills	Persistence Encouragement and warmth		Demonstrating flexibility and responsiveness: Persistence						Promoting learner motivation through feelings of competence, autonomy and relatedness				
		TALIS Video Study / Global Teaching Insights (OECD, 2020[30])	**CLASS** (Hamre and Pianta, 2007[86])	**Framework for Teaching** (Danielson, 2007[78])	**Mathematical Quality Instruction (MQI)** (Hill et al., 2008[87])	**PLATO** (Grossman et al., 2013[79])	**TEACH Primary** (Molina et al., 2022[87])	**UTeach Teacher Observation Protocol (UTOP)** (Walkington et al., 2012[80])	**Dynamic model of educational effectiveness** (Creemers and Kyriakides, 2013[81])	**Great Teaching Toolkit** (Coe et al., 2020[82])	**High Leverage Practices** (University of Michigan, n.d.[83])	**Principles of Instruction** (Rosenhine, 2012[84])	**Teaching and Learning Toolkit** (Education Endowment Foundation, 2020[85])	**Visible Learning** (Hattie, 2023[4])
Fostering classroom interaction	**Student collaboration**	Nature of discourse	Instructional learning formats (variety)	Engaging students in learning: Student Groups			Social and collaborative skills: Promote students' collaboration	Classroom interactions (collegial working relationships)	Application: Small group tasks for practice and application opportunities		Setting up and managing small group work		Collaborative learning approaches	Seeking help from peers

Observation frameworks								Evidence reviews and syntheses					
			Language modelling (conversation)				Classroom organisation (appropriate space management)	The classroom as a learning environment: Establishing on-task behaviour in student-student interaction					Cooperative learning
	Whole-class discussion	Nature of discourse Discussion opportunities	Language modelling (open-endedness)	Using questions and discussion techniques: Discussion techniques		Classroom discourse				Implementing norms and routines for discourse Leading a group discussion			Classroom discussion
	Questioning and responding	Questioning		Using questions and discussion techniques: Quality of questions, Student participation		Strategy use and instruction	Critical thinking: Open-ended questions	Implementation questioning (for participation, facilitating engagement, productive interaction) Implementation involvement (attending to participation rates)	Questioning (Raising different types of questions, time for responses, dealing with responses)	Questioning: using questions and dialogue to promote elaboration and connected, flexible thinking among learners	Posing questions about the content	Ask a large number of questions and check the responses of all students		Questioning

		Observation frameworks							Evidence reviews and syntheses					
		TALIS Video Study / Global Teaching Insights (OECD, 2020[30])	**CLASS** (Hamre and Pianta, 2007[86])	**Framework for Teaching** (Danielson, 2007[78])	**Mathematical Quality Instruction (MQI)** (Hill et al., 2008[87])	**PLATO** (Grossman, Hammerness and McDonald, 2009[68])	**TEACH Primary** (Molina et al., 2022[87])	**UTeach Teacher Observation Protocol (UTOP)** (Walkington et al., 2012[80])	**Dynamic model of educational effectiveness** (Creemers and Kyriakides, 2013[81])	**Great Teaching Toolkit** (Coe et al., 2020[82])	**High Leverage Practices** (University of Michigan, n.d.[83])	**Principles of Instruction** (Rosenhine, 2012[84])	**Teaching and Learning Toolkit** (Education Endowment Foundation, 2020[85])	**Visible Learning** (Hattie, 2023[4])
Using formative assessment and feedback	**Learning goals**	Explicitness of learning goals		Communicating with students: Expectations for learning		Purpose	Lesson facilitation: Explicitly articulates objectives and connection to activities	Content relevance (made explicit)	Orientation: Objectives, rationale Structuring: Beginning with overviews and/or reviews of objectives	Structuring: signalling learning objectives, rationale, overview, key ideas and stages of progress	Setting learning goals			
	Diagnosing student learning	Eliciting student thinking		Using assessment in instruction: Assessment criteria, Monitoring of student learning, Feedback to students, Student self-assessment and monitoring	Responding to students appropriately (e.g. correctly interpret students' mathematical utterances)		Checks for understanding: Questions, prompts, strategies to determine learning	Lesson assessments (gauge student understanding)	Assessment: Using appropriate techniques to collect data on knowledge and skills Assessment: Analysing to identify student needs		Eliciting and interpreting individual students' thinking	Check for understanding Require and monitor independent practice		Providing formative evaluation

Observation frameworks									Evidence reviews and syntheses				
	Feedback	Teacher feedback	Quality of feedback (feedback loops, encouragement of responses, expansion of performance)		Responding to students appropriately (e.g. address student misunderstandings)	Feedback	Feedback: Specific prompts or comments to clarify misunderstandings and identify successes			Interacting: responding appropriately to feedback from students about their thinking/ knowledge/understanding	Providing feedback to students		Feedback	Feedback
	Adapting to student thinking	Aligning instruction to present student thinking		Demonstrating flexibility and responsiveness: Lesson adjustment, Response to students	Responding to students appropriately (e.g. address student misunderstandings)		Supportive learning environment: Responds to students' needs	Implementation modification (modify lesson appropriately based on formative assessment)		Structuring: scaffolding and supporting to make tasks accessible to all, but gradually removed so that all students succeed at the required level	Attending to patterns of student thinking	Guide student practice	Individualised instruction	Scaffolding
										Activating: progressing appropriately from structured to more independent learning as students develop knowledge and expertise	Checking student understanding	Provide scaffolds for difficult tasks		

Observation frameworks									Evidence reviews and syntheses					
							Checks for understanding: Adjusts teaching to the level of students			Explaining: modelling/ demonstrating new skills or procedures with appropriate scaffolding and challenge	Coordinating and adjusting instruction			

Note: The table provides a comparison of some of the most well-established frameworks of teaching to provide an indication of their alignment with the Taxonomy. Rows represent similar conceptual ideas from across different frameworks that feed into a sub-dimension. Sub-dimensions may consist of more than one row, because more than one conceptual idea may feed into that sub-dimension. There are several dimension-specific frameworks that have been included under the heading 'Other', as they are primarily relevant to one particular dimension. Frameworks that are used for specific sub-dimensions are not included. The alignment work and frameworks considered will be revised based upon feedback from the review exercise.

2 Ensuring cognitive engagement

This chapter focuses on creating the conditions for students to put forth a sufficient and sustained effort to persist in understanding challenging, complex work. To do so, teachers ensure appropriate levels of challenge, embed meaningful context and real-world connections, facilitate first-hand experiences, work with multiple approaches and representations, and nurture students' metacognition. Teachers must carefully consider their role in both scaffolding and stretching student thinking, as well as in fostering students' ownership of their learning.

In Brief

- Cognitive engagement centres on learners putting forth a sufficient and sustained effort to persist in understanding a complex idea or solving challenging, unstructured problems.
- Student cognitive engagement is consistently positively associated with student achievement. It can also lead to greater student motivation, self-esteem and interest in learning.
- Teachers can foster cognitive engagement by:
- Ensuring appropriate levels of challenge
  - meaningful context and real-world connections
  - facilitating first-hand experiences
  - working with multiple approaches and representations
  - metacognition.
- Across these different practices, the teaching complexity centres on setting up learning opportunities where all students feel challenged and curious, but which also cater for differences in prior knowledge or student interests. Teachers must navigate how to guide cognitive engagement by scaffolding or stretching student thinking, as well as when they want to use students as drivers of this engagement.
- To foster students' cognitive engagement also demands teachers to be very cognitively engaged. Teachers need not just to notice but also to process and respond to students' thinking in real-time; for example, not just checking whether students are considering multiple approaches to problems, but whether they are appropriately evaluating these different approaches.
- The broader school environment shapes how teachers navigate such complexity and effectively implement practices. For instance, classroom size and composition, curricula flexibility, or the available resources and tools can help teachers in ensuring cognitive engagement, while opportunities to meaningfully understand their learners as individuals may shape how teachers meet different needs.

Understanding cognitive engagement

Cognitive engagement refers to the mental state in which learners put forth a sufficient and sustained effort to persist in understanding a complex idea or solving challenging, unstructured problems. Its particular value lies in supporting students to develop a deep understanding of content and an ability to apply this flexibly and adaptively to new situations or challenges (Blumenfeld, Kempler and Krajcik, 2005[1]; Pellegrino and Hilton, 2012[2]).

Cognitive engagement is situational in classrooms, which means it is not simply automatic, but rather occurs in a particular situation and context. Teachers can strive to create these situations in which learners can become cognitively engaged by drawing upon the core practices. These are united by creating challenge, sparking interest and curiosity, and connecting to students' prior skills and knowledge.

The impact on student outcomes

Engaging students in higher-order thinking is an important feature of instructional quality (Creemers and Kyriakides, 2006[3]; Creemers and Kyriakides, 2013[4]; Dunlosky et al., 2013[5]; Hattie, 2012[6]). Research in mathematics (Baumert et al., 2010[7]; Lipowsky et al., 2009[8]; Li et al., 2021[9]) and science (Keller, Neumann and Fischer, 2017[10]; Fauth et al., 2019[11]) has consistently shown that cognitive activation is positively associated with student achievement.

Research also suggests that there are notable benefits to non-cognitive outcomes such as student motivation and self-esteem (Fredricks, Blumenfeld and Paris, 2004[12]). Furthermore, when students are cognitively engaged, they also tend to be more interested (Fauth et al., 2014[13]).

Box 2.1. Notable debates and definitions

- It is challenging to discern the level of students' cognitive engagement. Observable behaviours, such as showing attention or moving their pencils to appear on task, do not necessarily indicate cognitive engagement. At the same time, relying on student-reported engagement, such as surveys and interviews which have often been used, have their limitations in that memories of engagement may fade over time.
- Students can appear to be cognitively engaged in an academic task while simultaneously being demotivated and disaffected by it (Schmidt, Rosenberg and Beymer, 2018[14]). However, emotional engagement can lead to greater levels of cognitive engagement by influencing students' energy and effort investment (Pekrun and Linnenbrink-Garcia, 2012[15]).

Teaching practices for ensuring cognitive engagement

Fostering students' cognitive engagement in the classroom is a fluid and ongoing process. After all, what is engaging might be different to every student and may change as students learn and progress. This means there needs to be sustained and careful attention to how cognitive engagement is facilitated in a classroom. To foster cognitive engagement, teachers can make use of the following practices:

- ensuring appropriate levels of challenge
- meaningful context and real-world connections
- facilitating first-hand experiences
- working with multiple approaches and representations
- metacognition.

All these practices are important and inter-connected, and teachers might draw upon them simultaneously. Ensuring appropriate levels of challenge is a practice that tends to be present throughout the teaching and learning process with teachers carefully attending to the cognitive load that learning opportunities present and their alignment with students' prior learning. Teachers may draw on practices such as providing meaningful contexts and real-world connections, working with multiple approaches and representations, and facilitating first-hand experiences, depending on the learning goal. They also selectively create opportunities for students to think metacognitively, enabling them to self-evaluate their learning progress and self-direct it forward, sometimes extending beyond a particular activity, task or lesson.

Figure 2.1. Cognitive engagement practices are interrelated

Each of these practices are outlined one-by-one below. Each section presents a definition for the practice and other associated terms on how it might also be referred to; key research findings on its impact on student outcomes; main implementation challenges identified by researchers and schools in designing the structure of the activity, task or content, role of students and role of teachers. Then, it looks into the complexity for teachers to understand whether students are cognitively engaged in the classroom. The final section builds on schools' insights to provide an indication about the complexities of implementation and provides reflection questions for instructional and school leaders.

Ensuring appropriate levels of challenge

The appropriate level of challenge relates to the opportunities for students to regularly engage in work that is demanding, thoughtful and complex. This is aligned to learning goals and informed by the subject matter as to how best to challenge students. It is also aligned to students' needs, including where they are in their learning, in order to ensure that all students, and not just some, are activated by hard, challenging work and being pushed forward in their thinking.

Associated Terms: *Demanding subject matter; Thinking critically; Intellectual challenge; Concept development; Cognitive activation; Ambitious teaching for all; High expectations*

Key research findings

Research on features of effective teaching has consistently identified a correlation between students being engaged in rich learning opportunities that activate hard thinking and student learning outcomes (Coe et al., 2020[16]; Klieme, 2006[17]; Neumann, Kauertz and Fischer, 2012[18]). Similarly, Chi and Wylie (2014[19]), whose work has focused on the synthesis of large bodies of research, including laboratory and classroom studies, on associations between learning outcomes and different teaching practices and classroom features, have argued that as students become more cognitively engaged, their understanding of the content deepens.

These arguments are supported by empirical studies too, such as recent work on the sequencing and scaffolding of challenging tasks when learning programming, which found benefits to student learning and self-reported engagement (Ma et al., 2023[20]), and work on immersing students in a state of 'flow' – where the use of high degrees of skills in challenging tasks results in deep concentration (Hamari et al., 2016[21]; Hsieh, Lin and Hou, 2016[22]).

What are some of the key considerations when implementing?

Structuring: How to pitch the right level of challenge?

The level of challenge needs to be carefully pitched; too easy for students and it is not a challenge, yet too hard and it is not achievable and potentially demotivating. To get the level of challenge right, teachers need to ensure there are appropriate entry points to the task alongside a clear progression in cognitive demands (McNeill et al., 2006[23]). This also demands careful consideration of students prior knowledge to build new connections (Coe et al., 2020, p. 33[16]) and progress to greater abstractions (Braithwaite and Goldstone, 2015[24]).

Insights from schools:

> ***To help students get going, it can be helpful to sometimes 'thinly slice' complex challenges*** *into multiple smaller steps that provide incremental challenge, so students experience a sense of success, rather than frustration, early on.*
>
> ***Consider students starting certain challenges working in groups****, so they can use each other as learning resources if they are struggling and so they feel less daunted by the scale of the challenge. They can then progress to a trying a similar challenge independently.*
>
> ***Ensure that there is a quick route to increasing the level of challenge when designing a task,*** *such as by having multiple correct answers that can be investigated or an open-ended aspect where students can seek out new applications of the challenge, so you can readily adapt.*

Students: Are students pushed to critically identify evidence that can explain and justify their thinking?

Numerous subject-specific studies have explored what engaging students in challenging work may look like. Whilst there is a degree of subject-specificity, some features are reasonably consistent such as critically and creatively engaging in analytical work, particularly involving using evidence and justifications. For instance, in mathematics, particularly demanding tasks include engaging in analyses and creation or evaluation work that requires thoughtfulness (Mishra and Koehler, 2006[25]; Nunokawa, 2010[26]; Lipowsky et al., 2009[8]). Similarly, in literature, a common theme has been the close analysis of texts to identify and evaluate patterns, connections, and contradictions with evidence (Beers and Probst, 2012[27]; Beers and Probst, 2016[28]) while in the social sciences and history, identifying and evaluating evidence has been argued as central too (Grant, Lee and Swan, 2017[29]; Monte-Sano, De La Paz and Felton, 2014[30]).

Insights from schools:

> ***Build in a routine of students providing justifications with supporting evidence****, whether it is with follow-up questions that ask "why?" of students or "justification boxes" in written activities. Asking students to solve an equation is distinct from additionally asking them to explain why the method used is the most effective to solve it.*
>
> ***Provide a clear model or scaffold*** *of how to evaluate evidence and accordingly build an argument, so students will know what to aim for. Indeed, it could be that this can be aligned with colleagues to provide a model or scaffold for handling evidence that can be used by students consistently across subjects.*

> ***Challenge students to give constructive feedback to their peers on their use of evidence during tasks**, which both trains students to systematically analyse a project using a rubric, and also emphasises the need for collaboration and feedback to refine one's thinking.*

Teacher: What is the right amount of teacher guidance to ensure a degree of student struggle and persistence?

A key feature of challenging work, such as problem-solving, is that it demands sustained thinking from students (Mayer, 1990[31]). This means students need to struggle and be stretched over a prolonged period. But what counts as challenging is subjective to every student and ever evolving in the classroom. This is, ironically, challenging for the teacher. Teachers need to balance the amount of guidance and support they provide in a flexible and adaptive way.

Insights from schools:

> ***Monitor students' work and thinking in an ongoing way**, so that that there is plenty of information to draw upon when judging if more or less guidance is needed.*
>
> ***Provide feedback on the processes and attempts**, even if wrong, when tackling complex challenges to encourage students to sustain their efforts and make them still feel a sense of success even if a problem isn't solved.*
>
> ***Provide time for students to pose their questions to each other first before intervening as a teacher**, say by collecting questions or challenges from individual students or groups, and asking the class "who can help their peers overcome this obstacle?"*
>
> ***Use prompts that provide directions rather than simply the solutions**. For instance, encourage students to look for patterns or "similarities and differences", both when they are struggling or in need of progression, or to summarise what they do know about a topic if they are looking for an entry point.*

Meaningful context and real-world connections

Students' learning is tied to its broader context and applications, including contexts that students find meaningful, important, and valuable. Teachers may create clear and detailed connections between what is being learned in the classroom to something outside of the lesson. This may use a concrete real-life example, a relevant problem, or students' personal experiences. In each case, these decisions are informed by the teacher's consideration of students' cultures and backgrounds.

***Associated Terms:** Authentic learning; Application; Purpose; Problem- or project-based learning; Inquiry-based learning*

Key research findings

A recent systematic review of approaches to primary science teaching identified that context-based and cross-curricular/interdisciplinary approaches can have a positive effect on pupil attainment and on attitudes (Bennett et al., 2023[32]). Whilst the review considered a small sample of studies (six), all were quasi-experimental or randomised control trials. The majority were rated as of moderate quality and spanned several different countries. Specifically, the review included four studies specifically related to context-based approaches, defined as those in which scientific concepts and process skills are applied in real-life contexts relevant to pupils from diverse backgrounds. That said, there can be variation in how 'context' is interpreted with it being a broad term, meaning that critical, sensitive engagement with the evidence is needed by teachers and school leaders. Similar findings emerge at the secondary level too; a review of secondary science foregrounds the importance of building on students' preconceptions and ideas (Nunes et al., 2017[33]): the ideas about the world that students already have and bring to the classroom. Conversely, research on the use of 'not-real' examples, for instance using fictional places in geography or

fictional historical events, in subject content may limit the usefulness of the knowledge students learn, as well as their curiosity and inquiry (Puttick, 2017[34]).

Elsewhere, the use of meaningful, complex real-world problems or authentic inquiry questions has also been a notable feature of interventions on project-based learning approaches. This body of research provides some indirect evidence that when students engage in building their understanding by working with and using ideas in real-world contexts this can be impactful for their learning (National Research Council, 2007[35]). For instance, there is evidence from large-scale randomised control trials in the US suggesting that contextualised project-based learning in science can be impactful; one trial with primary students suggested it can contribute to student learning gains (Krajcik et al., 2023[36]) and another at the secondary-level found effects on students' motivation to learn (Schneider et al., 2022[37]). As noted, this means that empirical evidence is primarily indirect in this body of research, with it rare that studies isolate the specific effects of contextualised learning. Rather, the use of meaningful context and real-world connections is often one feature of several combined approaches (Sweller et al., 2023[38]). Similarly, the consistency of these findings has also been mixed, with a need for further rigorous research still (Menzies et al., 2016[39]).

What are some of the key considerations when implementing?

Structuring: What is the appropriate level of diversity?

A diversity of examples and experiences can help students understand how ideas, knowledge or skills apply to different situations. It can also support equity and inclusion by ensuring that all students have opportunities to engage in learning that is meaningful to them, which has been an area of much research recently in different international contexts in relation to historically under-resourced or disadvantaged communities (Sánchez Tapia, 2020[40]). Empirical studies have suggested that contextualising learning in a culturally relevant way may support learning gains for the target students (Krajcik, Miller and Chen, 2020[41]; Sánchez Tapia, Krajcik and Reiser, 2017[42]).

Insights from schools:

> ***Ensure representation*** *when choosing content and topics, for instance books, primary sources, or real-life figures, so that students can see themselves in the content.*
>
> ***Enlarge students' thinking*** *by introducing students to cultures and backgrounds other than their own, if possible building upon the diversity in the classroom.*
>
> ***Encourage students to think about whose story or perspective is missing****, and how this could add additional value to their understanding.*

Students: Can students shape how their learning connects to the real world?

One means of ensuring that learning is authentic and engaging for students is to give them a role in shaping the types of connections that are made and the direction that their learning takes. This use of student agency can help to ensure that learning aligns to their interests and encourage their cognitive investment (Deci and Ryan, 2016[43]; Fu, Liu and Zhang, 2023[44]; Parker et al., 2021[45]). Teachers balance student agency with their own supervision, to monitor alignment with learning goals and prior learning, and help manage potential risks (OECD, 2024[46]).

Insights from schools:

> ***Use student voice to design questions that students want to investigate and answer during a topic****. They can come up with individual questions about things they care about in the world, or find peers with similar questions to develop a shared focus to investigate.*

> ***Give students responsibility to work for real purposes and real audiences*** *– such as on local issues – where they can have real-world impact by sharing the outcomes of their work with different stakeholders.*
>
> ***Encourage students to pursue their interests and curiosity outside of the classroom****, such as by challenging them to seek out additional resources or perspectives that can then be shared with their peers.*

Teacher: How to understand student preconceptions to facilitate connections?

If teachers are to be able to connect students' learning to their lives and the real-world, it is important that they understand students' starting points. Connecting the subject matter with students' initial ideas about the world by using relevant and accessible real-world examples has scope for generating rich cognitive engagement. More broadly, it is important that new learning is connected to prior knowledge to reinforce and deepen it (Rogers and Thomas, 2022[47]).

Insights from schools:

> ***Ask students at the beginning of a new topic about their backgrounds****, perspectives and how they relate personally to the subject at hand in order to be able to build connections with their learning.*
>
> ***Choose the right balance of open- or closed-ended opportunities****; open-ended opportunities, such as essays or one-to-one meetings, take more time but let students express themselves in detail in their own words, whilst close-ended opportunities like pre-surveys are more direct and efficient but lack some detail.*
>
> ***Consider creating ongoing opportunities for understanding who students are****, such as talking circles at the start of certain days to share personal stories and build connections, because both students' interests and real-world connections may evolve over time.*

Facilitating first-hand experiences

First-hand experiences refers to individuals learning through experiencing, seeing, feeling, and modelling phenomena that occur in the world. However, it is not just students observing what happens: first-hand experiences should involve students making sense of the phenomena. They should have the opportunity to explore questions like why does a phenomenon occur, or can they predict when the phenomenon will occur again?

Associated Terms: *Problem- or project-based learning; Inquiry-based learning; Authentic learning; Experiential learning; Participatory learning; Play-based learning; Hands-on learning; Application*

Key research findings

First-hand experiences have been investigated in different fields of research. One is the aforementioned body of research on the use of inquiry-based activities, particularly in science education. Some research has suggested that instructional approaches focusing on investigations and first-hand experiences (e.g. conducting investigations and using data to build models and explanations), integrated with content learning, are more effective and stimulate greater student interest in science compared to when students follow predefined procedures (e.g. memorisation and demonstration activities) (National Research Council, 2007[35]). A meta-analysis of experimental and quasi-experimental studies suggests that inquiry activities which combine procedural, epistemic, and social elements, can have a significant positive impact on student learning (Furtak et al., 2012[48]). However, it is worth noting that some questions have been raised regarding studies showing more mixed results and more work with the use of rigorous design features still being needed internationally (Menzies et al., 2016[39]).

A second field of research is that related to the concept of 'play'. There has been a notable amount of research in this field with younger students, both at the primary and early years levels. However, the evidence base is diffuse, with a strong conceptual basis from research in developmental theory on the use

of guided play (Zosh et al., 2017[49]). It is only more recently that a more coherent, systematic evidence base has started to emerge (Baron et al., 2017[50]; Whitebread et al., 2019[51]), though demands further examination. A recent meta-analysis on lower primary students (ages 1 to 8) examining the use of 'guided play' (constituted by a clear learning goal, a degree of student agency, and flexible teacher support, with students) found that it had a greater positive effect compared to direct instruction on executive function and mathematics (Skene et al., 2022[52]). As mentioned, research is heavily concentrated among primary age students or younger.

A particularly important debate relates to when first-hand experiences may be most appropriate. There is reasonable consensus on the importance of ensuring that students have sufficient prior knowledge for engaging in more student-led first-hand experiences such as inquiry approaches (de Jong et al., 2023[53]; Sweller et al., 2023[38]). Thus, it is only with sufficient mastery of the knowledge or skills underpinning a first-hand experience that a student can engage with more inquiry-orientated work. Even then, the role of teacher guidance remains important – as set out further below. In particular, there is a need to further examine how variation may exist across different age groups, as the question of prior knowledge is especially relevant for younger students which in turn raises the question of their ability to engage effectively in certain first-hand experiences.

What are some of the considerations when implementing?

Structuring: Do experiences align to student learning and the wider learning goal?

It is important that first-hand experiences have a clear purpose that is focused on the learning goals. Otherwise, first-hand experiences may become a distraction and add unnecessary cognitive load (Kolb, 2014[54]; Willingham, 2009[55]). Again, this connects to the need to ensure that students have the right type of prior knowledge and skills for engaging in any processes where they must explore a topic and try to make sense of it or solve a particular question (de Jong et al., 2023[53]; Sweller et al., 2023[38]). Experiences need to align to students' prior knowledge and skills so they can successfully apply them and that all students can access the experience.

Insights from schools:

> ***Start with a clear articulation of the 'why' behind the experience*** *that links together what students are learning with the relevance of the experience to give authenticity and meaning to it, as well as any keys skills or knowledge they have previously worked on.*
>
> ***Activate prior knowledge on key concepts or ideas first****, such as through recap activities, so that students retrieve previous learning and are ready to use it before they start engaging in a new inquiry or exploration.*
>
> ***Keep coming back to the goals regularly during the experience****, by embedding student reflection in a regular, sustained manner so they link back to the 'why' that underlies an experience.*
>
> ***Wrap up experiences with students explaining clearly what they have learnt*** *from the experience in relation to the learning goal, such as by creating individually or collectively a mind-map of their learning.*

Students: Are students exercising agency through more open-ended, student-led experiences?

Opportunities for students to play or engage in exploring and experimenting with ideas may support their ability to think in creative and iterative ways (Zosh et al., 2017[49]). There are many forms of play-based learning that are informed by the age of students, and there can be varying degrees of teacher involvement. They are typically united by a focus on students having agency to be creative and iterative in their thinking, around an underlying meaningful context.

Insights from schools:

> ***Ensure students have opportunities to experiment with trying out different ideas**, such as when modelling certain phenomena or using certain research methods, as these can be chances to reflect, think iteratively, and refine their inquiry approaches.*
>
> ***Give students the agency to choose how they communicate outcomes** from an experience in new, original ways, for instance how they present the outcomes from an inquiry (e.g. presentations, posters, videos).*
>
> ***Draw upon relevant forms of gamification**, for example by inserting activities like word clouds, multiple choice quizzes, or fill in the blanks, that may be particularly relevant for practising specific knowledge, or more open-ended gamification like role-play that demands more creativity.*

Teacher: How to offer appropriate guidance that ensures the experience is impactful?

In recent years, the important role of the teacher as a guide and facilitator for activities relating to inquiry has become increasingly clear. Evidence suggests that teacher guidance through an inquiry process has an additional positive effect, a result that has been reasonably consistent across various meta-analyses of inquiry-, problem- and project-based approaches (Lazonder and Harmsen, 2016[56]; Belland et al., 2017[57]). This suggests that first-hand experiences that have high levels of student agency still demand careful facilitation and support from the teacher.

Insights from schools:

> ***Provide students with clear definitions and model examples** of the key command terms and skills the experience is using (e.g. evaluate, justify, discuss, demonstrate), so that students can easily refer back to them.*
>
> ***Build consistency across the schools using inquiry-based language**, the terms should be the same across subjects and across age groups, so that students consistently know what we mean by key terms like 'hypothesis'.*
>
> ***Facilitate peer exchange** – sometimes the direct guidance is not explicitly from the teacher but insofar as the teacher facilitating the connections between students so they can share some of their approaches and early findings. This peer feedback can disseminate ideas but also refine those ideas.*

Working with multiple approaches and representations

Students have the opportunity to consider information or concepts in different representations to deepen understanding and support the retention of key ideas. This may look different across subjects, including students considering different approaches to solving problems or achieving particular learning goals, or considering different perspectives when it comes to interpreting information or concepts.

In each case, to be impactful students should focus on understanding the connections between these different representations or the different approaches to problems and challenges; students are not merely seeing multiple perspectives but critically thinking about them and where there are similarities and differences.

***Associated Terms:** Multiple representations; Multiple approaches or strategies; Multiple perspectives*

Key research findings

There is a large body of theoretical work on the use of multiple representations and approaches and how the brains function (Mayer, 2002[58]; Paivio, 1990[59]). These are grounded in a range of primarily small-scall empirical studies, though meta-analytical research suggests this practice can be impactful for student learning. A meta-analysis of 11 studies found that combining texts and images leads to deeper and more useable knowledge as compared to when only text and images are used alone (Mayer, 2002[58]).

There is a notable body of research on mathematics education. Rau et al. (2015[60]) conducted experiments with some 250 students on the learning of fractions in mathematics, finding that the use of multiple

graphical representations may support better learning than single graphical representations, provided that students are supported in relating graphical representations to key concepts. Similarly, in mathematics students can be encouraged to consider 'multiple solution paths' and consider the validity of different approaches (Baumert et al., 2010[7]), with the depth at which these are considered potentially shaping what students learn (Baumert et al., 2013[61]).

The potential impacts of using multiple representations and approaches seemingly stretches across subjects. There is a long history of considering 'multi-perspectivity' in subjects such as history (Stradling, 2003[62]; Wansink et al., 2018[63]), and some empirical evidence with older students in college when they are engaged in working with contrasting cases (Schwartz and Bransford, 1998[64]). Similarly, the use of constructing multiple representations of content in the teaching of science, particularly visual representations, is also well-established (Ainsworth, 2014[65]).

What are some of the key considerations when implementing?

Structuring: How to navigate between breadth and depth?

Teachers' careful and selective use of multiple representations, such as both verbal and non-verbal representations simultaneously (Mayer, 2002[58]; Paivio, 1990[59]), can be beneficial for students by deepening their understanding of content and supporting its retention. However, teachers need to avoid unnecessary cognitive load on students that may confuse them by scaffolding the connections between different representations or approaches (Kirschner, 2002[66]; Willingham, 2009[55]).

Insights from schools:

> ***Introduce different representations of an idea one-by-one at first**, so students can develop a good understanding of them in isolation first.*
>
> ***Show two different representations of an idea, or different perspectives or approaches to a problem, side-by-side** when moving to consider multiple representations, so that students can look across and identify specific similarities or differences.*

Students: Would students benefit from developing their own representations or trying different approaches?

When students develop their own multiple representations of content it can give them practice opportunities to express what they know and can do (Schwarz, Passmore and Reiser, 2017[67]). In particular, it allows them to try make connections, which can be helpful as students have to retrieve and apply their knowledge to new situations.

Insights from schools:

> ***Challenge students to transform content into new forms**, such as a text into a new visual form, or rewriting material for a different audience or from a different perspective.*
>
> ***Encourage students to think in an interdisciplinary way**, such as by bringing in similar representations that they have used in another subject, or by pushing students to make a connection with another topic.*
>
> ***Sustain a classroom culture that values difference** where students are encouraged to see the multiple ways of approaching ideas or problems and feel safe to try things out.*

Teacher: How can students be guided to see the connections between different representations or approaches?

Supporting students to consider multiple approaches and generate alternative solutions can promote flexible thinking (Li et al., 2024[68]). While students may sometimes identify connections themselves,

complex relationships often require modelling and explanation (Ainsworth, Wood and Bibby, 1996[69]; Van Meter et al., 2020[70]). For instance, a meta-analysis of 27 studies found that signals highlighting connections between text and pictures can support comprehension, suggesting it is a relevant design principle for the use of multiple representations, especially for learners with lower prior knowledge (Richter, Scheiter and Eitel, 2016[71]). The teacher validating these connections is crucial to avoid confusion or misconceptions.

Insights from schools:

> ***Use selective prompts and signals*** *that help draw students' attention to key features of a representation to reduce cognitive load.*
>
> ***Demonstrate the relationship between different representations by showing how they vary when key features slightly change****, such as how changing an equation impacts a graphical and algebraic representation in maths or science, or how different extracts of sources can lead to different perspectives.*
>
> ***Bring students together to discuss their different representations or perspectives of a shared focus****, such as their different interpretations of an artefact.*

Metacognition

Metacognition refers to students having opportunities to think about or reflect upon their own thinking and learning. Students do this by applying different metacognitive strategies depending on the learning context, and students should have opportunities to learn about these strategies and to practise applying them. In general, metacognitive strategies comprise metacognitive knowledge and metacognitive skills, with the former emphasising deeper understanding of their own learning habits and the latter focused on using such understanding to enhance cognitive learning.

Associated Terms: *Self-regulation; Self-monitoring; Metacognitive strategies; Metacognitive knowledge; Metacognitive skills; Learning about learning*

Key research findings

There is a strong body of research on the use of metacognitive strategies in the classroom. A meta-analysis of 246 studies observed positive effects across both, primary and secondary pupils, and various subjects, with approaches in mathematics and science being particularly successful (Education Endowment Foundation, 2021[72]). This is a reasonably consistent finding in meta-analytic work on a range of subjects and age groups over the past decade (Credé and Phillips, 2011[73]; Ohtani and Hisasaka, 2018[74]). In particular, students' active use of metacognitive strategies, such as think-aloud methods, seems particularly relevant; for instance, a recent meta-analysis on mathematics studies found that this type of metacognitive thinking during math problems was associated with increased performance (Muncer et al., 2021[75]).

More broadly, evidence on the use of metacognitive strategies is generally limited by small sample sizes, which weaken their statistical power and the generalisability of their findings. Additionally, analysing a more diverse range of metacognitive approaches is needed to ensure the effectiveness of various cognitive strategies, fostering more comprehensive and adaptive learning techniques. One ongoing measurement challenge in metacognition relates to capturing in-the-moment metacognition and retrospective metacognition (often referred to as "online" or "offline" metacognition). Some studies have found a disconnect between these types of measurements (Fleur, Bredeweg and van den Bos, 2021[76]).

What are some of the key considerations when implementing?

Structuring: Do all students know how to reflect about their own thinking and learning?

Research evidence indicates that metacognitive strategies can be explicitly taught, and that doing so is beneficial for students (Perry, Lundie and Golder, 2018[77]; Schraw, 2001[78]). For instance, positive correlations have been found between the explicit teaching of metacognitive strategies and language mastery and writing performance (Colognesi et al., 2020[79]), biology learning (Ministry of Education, Nuray Tuncay Kara Science and Art Center, 2021[80]), and self-efficacy in mathematics (Amal and Mahmudi, 2020[81]). In particular, disadvantaged pupils may be less likely to use metacognitive strategies without being explicitly taught these strategies (Education Endowment Foundation, 2021[72]).

Insights from schools:

> ***Provide concrete examples*** *of the type of impactful metacognitive thinking that students should be aiming for when they are critically thinking about their learning.*
>
> ***Model thinking out loud to show how one can actually navigate challenges and struggles****, so students don't just see 'successful examples'. For instance, when hitting an obstacle in problem-solving or inquiry processes, and the strategies that could be used to move forward.*

Students: Is metacognition effectively embedded in students' habits?

It is important that students actively apply and practise metacognition as part of their learning (Allen and Hancock, 2008[82]). Metacognitive reflection during or upon task completion can improve students' academic performance (Peters and Kitsantas, 2010[83]; Michalsky, Mevarech and Haibi, 2009[84]). Teachers need students to develop their own acumen on how they should respond to the wide range of learning situations they encounter within each subject matter.

Insights from schools:

> ***Develop clear routines for thinking metacognitively****, such as at the end of lessons or topics (e.g. "I used to think… and now I think…"; or "I can now use… but I need to do more of…") or during ongoing inquiry process (e.g. revisiting, redrafting, critiquing).*
>
> ***Provide variation in how students communicate and log their metacognitive thinking****, such as peer-to-peer or whole-class dialogue, or different written and multimedia formats that document their learning journeys, to sustain interest and engagement in the process.*
>
> ***Be mindful of student attention shifting to only the negative aspects*** *– such as shortcomings or things as yet unachieved – as some students can spiral into obsessing on perfection, and there needs to be a support to ensure the reflection is not overwhelming and counter-productive.*
>
> ***Prompt students to think back to similar learning experiences*** *when they are exercising choices and decisions, such as by asking them to consider "What was a challenge when you adopted this approach though last time?" or "What was a main takeaway on this topic last semester?".*

Teacher: What connections can be made to embed strategies in the subject matter?

It is important to contextualise the use of metacognitive strategies to the content and subject matter that students are focusing on (Muijs and Bokhove, 2020[85]). This can help to make strategies more tangible and explicit. Students who use metacognitive strategies effectively on a particular subject matter might not do so as effectively for tasks of a different subject matter (Education Endowment Foundation, 2021[72]).

Insights from schools:

> ***Co-develop with students a 'toolbox' or 'logbook' of the subject's key problem-solving strategies**, methods and processes, revisiting this to add in the scenarios and topics where students have used the subject's different 'tools' so they can refer back to it when struggling with a new scenario.*
>
> ***Encourage students to explicitly immerse themselves in the thinking process of experts**, such as 'thinking like a Historian or a Mathematician', or by using examples from real-world experts.*

Observing the effects on students

Because students' cognitive engagement can be malleable and unpredictable, it demands constant monitoring (Symonds, Schreiber and Torsney, 2021[86]). Teachers are constantly looking for signals from students to gauge whether their implementation of teaching practices is effective or not. Teachers use their professional judgement in the classroom to perceive and process these signals.

Schools' insights on the in-situ classroom signals for cognitive engagement (Table 2.1) provide an indication of the cognitive load that teachers undergo in noticing, processing and responding to them when teaching. These signals can be thought of as the short-term, in-class manifestation of the long-term knowledge, skills, values, and attitudes that teachers seek to encourage.

- **Knowledge:** Teachers need to be adept at recognising when students demonstrate deep understanding, evidenced by well-reasoned ideas, the ability to make real-world connections, and the effective transfer of knowledge to different contexts. Some of these aspects might be easy to interpret, such as when students provide a response, but others might require more cognitive load from teachers, such as discerning how well students connect concepts across different disciplines or apply knowledge in novel ways.
- **Skills:** Teachers must notice when students exhibit critical thinking, cognitive flexibility and problem-solving skills. This requires a sophisticated understanding of the processes behind learning and an ability to observe not just outcomes, but the strategies students employ. These seem particularly tied to specific actions from the teacher to bring them to the surface, such as how a task is designed or the particular questions that are asked.
- **Values and Attitudes:** Recognising students' motivation, sense of purpose, openness to new ideas, and respect for diverse perspectives demands that teachers pay close attention to students' affective state in the classroom. It might also need a higher level of differentiated attentiveness to avoid being driven by only overt signals from, for example, high achieving or extrovert students.

Notably, large class sizes, diverse student needs, and external distractions can all hinder a teacher's ability to accurately assess student signals.

Table 2.1. Signals of students' cognitive engagement in classrooms

	Knowledge	Skills	Values and attitudes
Ensuring appropriate levels of challenge	Students demonstrate new knowledge that is well-reasoned with evidence.	Students self-sustain their focus even in the face of setbacks.	Students are engaged in their work and motivated to go beyond what they are expected to do.
	Critical thinking, creativity	Resilience, tolerance for complexity and ambiguity	Curiosity, sense of purpose
Meaningful context and real-world connections	Students make accurate and detailed connections between their learning and the real world.	Students consider the relevance of different contexts and connections, and what may be missing.	Students seek out purposeful applications of their learning that can create real impact.
	Cognitive flexibility	Perspective taking, open mindset	Sense of responsibility, sense of purpose
First-hand experiences	Students transfer ideas from experiences to more abstract ideas and new challenges.	Students monitor and adapt first-hand experiences to direct them towards a specific focus.	Students are eager to explore and try out different ideas.
	Cognitive flexibility, agility	Locus of control	Open mindset
Working with multiple approaches and representations	Students use different ways to articulate key ideas or solve problems.	Students discern and justify the relevance of different approaches and when to use them.	Students appreciate different ways of thinking and how they may be used.
	Problem-solving		
	Students draw appropriate connections between different approaches or representations.	Perspective taking skills, critical thinking	Open mindset, empathy, respect
	Cognitive flexibility		
Metacognition	Students know how to apply different metacognitive strategies in effective ways to support their progress.	Students are continually aware of their needs and levels of understanding.	Students seek out opportunities to reflect on their learning and act upon it.
		Self-awareness, reflective thinking	
	Adaptability, manage risks	Students use information and reflection on their progress to inform decisions on their learning.	Locus of control, self-awareness
		Reflective thinking, locus of control	

Note: The signals are based on the contributions from the Schools+ Learning Circle and have been mapped to the 'transformative competencies' of the OECD Learning Compass in green.

Unlocking the potential to ensure cognitive engagement

Cognitive engagement is shaped by the actions of teachers in the classroom and is also informed by broader actions at the school- and system-levels. A deeper exploration of the complexity of engaging students cognitively can shed light on how school and system leaders can create supportive environments for quality cognitive engagement in classrooms.

For instance, how teachers are allocated to learners, including factors like class size and classroom composition, or any additional support from teaching assistants, can make a significant difference. Each student is unique; what is challenging for one may not be for another. The larger and more diverse the classroom, the more challenging it becomes to understand individual needs and orchestrate how students are challenged. More diverse classrooms are likely to increase the complexity of differentiation, scaffolding, and monitoring to maintain appropriate cognitive challenges.

Teachers' opportunities for planning, the flexibility of the curricula, and the availability of teaching resources can be helpful in being more responsive to specific class and student needs. This can be particularly useful in navigating the many tensions in balancing the cognitive load of learning: finding the right depth and breadth, ensuring relevance, and maintaining appropriateness. For instance, to foster meaningful contexts and real-world connections, teachers do not necessarily need to reinvent the wheel every single lesson; a trusted bank of educational resources can facilitate more meaningful context and real-world applications, and tools can help adapt a single concept into diverse formats (visual, textual, etc.).

A school-wide approach might be beneficial to introduce relatively new practices such as metacognition, helping students 'think' about their own learning. The school's use of consistent language and approaches around metacognition can be significant; explaining and embedding strategies in a way that transcends individual classrooms to build a more holistic approach to metacognition across lessons may be powerful.

A school-wide approach might also be needed for practices such as first-hand experiences that diverge from the historically traditional classroom structure. If these experiences are to take on an interdisciplinary nature, they may require flexibility in the curriculum and opportunities for collaboration among colleagues. Many first-hand experiences also invite a reimagination of the learning spaces or even connections with other learning environments, such as local communities and wider digital networks. Moreover, student learning might be harder to monitor and more susceptible to distractions, and school-level behaviour policies and routines for learning may provide teachers with tools for managing more challenging classroom structures.

Box 2.2. Schools' strategies to strengthen cognitive engagement practices

At **Canyon Falls School** in Canada, part of the Networks of Inquiry and Indigenous Education (NOIIE), school leaders and teachers have co-developed a school-wide approach to fostering metacognition in lessons. Curricular leaders are responsible for leading monthly professional learning sessions that focus on how to implement different metacognitive activities and, significantly, how to critically assess their effectiveness. Teachers allocate approximately three hours a week to co-planning lessons with colleagues, which has helped to build consistency in implementation across lessons and foster a shared understanding of metacognition goals.

At **Beijing Haidian Minzu Primary School** in China, teachers participate in monthly professional learning guided by mathematics experts to learn how to structure classroom activities and to formulate questions that enable students to examine multiple approaches and representations. New mathematics teachers receive in-school training from experienced colleagues on practical methods to begin using this practice, and then ongoing mentoring to continue to refine this practice. School leaders also maintain some oversight to help monitor quality, observing new teachers' classes annually.

At **Trnovo Basic School** in Slovenia, teachers attend professional learning sessions to enhance their facilitation of impactful first-hand experiences. Organised by the National Institute of Education, these sessions focus in particular on how to assess students' learning progress when they are completing collaborative research projects. Additionally, in-school workshops are organised every two months for teachers to evaluate their methods and achievements, review the impact of projects on students, and jointly seek solutions for different instructional challenges.

In navigating the challenge of enabling high-quality cognitive engagement in classrooms, school and system leaders may carefully consider some of the following questions:

- How can school leaders empower teachers with the necessary mindsets, skills, and resources to consistently challenge students at appropriate levels? What strategies for student groupings, in

terms of both type, size and length, can be implemented to support differentiated instruction where appropriate?

- What is the school's identity within its local community, and how does it connect to the broader world? What structures and partnerships can the school leadership establish to ensure that local identity and diversity are meaningfully integrated across curricula in various subjects? How does this translate into the school's physical space (e.g. displays, art)?
- How can school spaces become more versatile learning environments? More broadly, how can the allocation of school resources – time, staff and finances – facilitate quality first-hand experiences for all students, such as through field trips and laboratory experiences at appropriate moments in student learning?
- In what ways can a culture of professional collaboration among teachers, both within and outside the school, be cultivated to enhance access to high-quality learning resources and tools? How can this collaboration support teachers in adopting multiple approaches and representations in their teaching practices?
- How can schools be structured to provide dedicated time and space for both students and teachers to engage in metacognitive practices, such as reflective meetings, peer observations, and self-assessment sessions? How is this aligned to the school's overall commitment to continuous improvement and reflection?

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Annex 2.A. Summary of considerations and insights for the practices of cognitive engagement

Annex Table 2.A.1. Summary of considerations and insights for the practices of cognitive engagement

	Structure of the task, activity or content	Role of students	Role of teacher
Ensuring appropriate levels of challenge	How to pitch the right level of challenge? • 'Thinly slice' complex challenges • Working in groups, so they can use each other as learning resources • Quick route to increasing the level of challenge.	Are students pushed to critically identify evidence that can explain and justify their thinking? • Build a routine to provide justifications with supporting evidence. • Use a model of how to evaluate evidence. • Challenge students to give constructive feedback to peers on their use of evidence.	What is the right amount of teacher guidance to ensure a degree of student struggle and persistence? • Monitor student's work in an ongoing way. • Provide feedback on processes and attempts. • Provide time for posing questions to each other before intervening. • Use prompts to provide directions, not simply solutions.
Meaningful context and real-world connections	What is the appropriate level of diversity? • Ensure representation in content and topic choices. • Introduce students to cultures and backgrounds different than their own. • Encourage students to think about missing perspectives.	Can students shape how their learning connects to the real world? • Design questions that students want to investigate and answer. • Give responsibility to work for real purposes with real-world impact. • Encourage students' interests and curiosity beyond the classroom.	How to understand students' preconceptions to facilitate connections? • Ask about student's perspectives at the beginning of a new topic. • Balance open- or closed-ended opportunities. • Create opportunities for understanding who students are.
Facilitating first-hand experiences	Do experiences align to student learning and the wider learning goal? • Articulate the 'why' behind the experience, linking student's learning with its relevance. • Activate prior knowledge on key concepts and ideas. • Come back to the goals regularly through student reflection. • Wrap up experiences with students explaining what they have learnt.	Are students exercising agency through more open-ended, student-led experiences? • Ensure opportunities to try out different ideas. • Give student's agency on how to communicate outcomes. • Draw upon relevant forms of gamification.	How to offer appropriate guidance that ensures the experience is impactful? • Provide clear definitions and model examples. • Build consistency in the inquiry-based language used across subjects and age groups. • Facilitate peer exchange to refine ideas through feedback.
Working with multiple approaches and representations	How to navigate between breadth and depth? • Introduce different representations and ideas one-by-one. • Show two different	Would students benefit from developing their own representations or trying different approaches? • Challenge students to transform	How can students be guided to see the connections between different representations or approaches? • Use selective prompts and signals.

	approaches to a problem side-by-side.	content into new forms. • Encourage interdisciplinary thinking by making connections across topics. • Sustain a classroom culture that values difference.	• Demonstrate the relationships between different representations. • Discuss student's different representations or perspectives of a shared focus.
Metacognition	Do all students know how to reflect about their own thinking and learning? • Provide concrete examples of impactful metacognitive thinking. • Model thinking out loud to navigate challenges and struggles.	Is metacognition effectively embedded in students' habits? • Develop clear routines for thinking metacognitively. • Vary how to communicate and log metacognitive thinking. • Be mindful of student attention shifting to only the negative aspects. • Think back to similar learning experiences.	What connections can be made to embed strategies in the subject matter? • Co-develop with students a 'toolbox' of key problem-solving strategies. • Encourage students to immerse themselves in the thinking process of experts.

3 Crafting quality subject content

This chapter focuses on building a deep understanding– from the core ideas and skills to a critical eye of how to apply these. Teachers ensure quality subject content by crafting explanations and expositions, providing clear, accurate and coherent contents, making connections, and interrogating the nature of the subject. Its complexity hinges upon understanding how to look both backwards to students' prior learning and outwards to new applications or generalisations to build understanding that is robust and rich.

In Brief

- Subject content focuses on the transmission of propositional knowledge - information and facts expressed in spoken or written sentences – and tacit knowledge - ways of doing subjects or its explicit procedures.
- Whilst the quality of the subject content is often assumed in many research studies, high-quality content is a notable feature of reviews of effective teaching and large-scale studies of students' opportunities to learn.
- To foster quality subject content, teachers can make use of the following practices:
  - crafting explanations and expositions
- clarity, accuracy and coherence
  - making connections
  - nature of the subject.
- Across these practices, it can be complex for teachers to ensure students attain a suitable depth of knowledge while also balancing their ability to apply this knowledge in a range of ways. It also demands balancing between looking backwards to students' prior learning as well as looking outwards to explore connections and patterns in the subject matter.
- Monitoring the quality of subject content for students needs a high-level professional expertise from teachers. To gauge the effectiveness of implementing practices, teachers need to look for certain signals as the class progress, such as students being able to extrapolate from connections to make wider generalisations or being able to accurately recall information even after a time delay.
- The broader school environment shapes how teachers navigate such complexity and effectively implement practices. For instance, sufficient quality time for planning and professional collaboration – both within a department and more widely – may shape how learning opportunities are sequenced to build robust, deep understanding, while the resources and tools available to teachers may influence how content is explained and its connections presented.

Understanding quality subject content

The quality of the subject content taught in schools and settings plays a foundational role for students' outcomes. It is important to emphasise that what students are learning must be of a high quality, or the quality of pedagogy is immaterial. Hence, it is not enough for students to be learning just something: what they are learning must be of a high quality.

Subject content includes both building a deep understanding around propositional knowledge (information and facts that can be captured and expressed in spoken or written sentences) and ways of doing subjects (including explicit procedures and wider tacit knowledge). It also encompasses students working with connections, patterns and generalisations in the content, and across content. To support this deep understanding of the content, teachers ensure that there are high levels of clarity and accuracy in student learning, and that content is carefully sequenced to be coherent. In this respect, teachers need to carefully consider both the question of what is being taught – working with the context of the curriculum – and how it is being taught.

The impact on student outcomes

The relationship between what students are taught and the success of their education is widely assumed across research and practice. Hence, the area of quality subject content is often an assumed dimension of teaching that is implicit in other studies of outcomes and effectiveness (Mejía-Rodríguez and Kyriakides, 2022[1]) rather than operating as the primary focus. This means that the evidence this dimension draws upon is more disparate, as there is not a coherent, self-defined body of research on the concept of 'Quality Subject Content'.

In terms of student outcomes, reviews of effective teaching have identified the importance of the quality of the subject content that students encounter. This is often focused on the knowledge of the teacher. Coe and colleagues' (2014[2]) major review placed pedagogical content knowledge as their number one feature of effective pedagogy, citing the importance of teachers having 'deep knowledge of the subjects they teach' (p. 2[2]) to help their students to learn more, teachers should 'understand the content they are teaching and how it is learnt' (p. 5[2]).

Box 3.1. Notable debates and definitions

- What is a subject and its knowledge base? This is often either taken for granted or taught to students implicitly. It can be seen to encompass aspects such as:
  - how you 'do' the subject (e.g. reading and writing, using numbers, carrying out experiments, designing and creating),
  - and what counts as knowledge (e.g. the core body – or 'canon' – of knowledge in the subject, and more abstract ideas of how knowledge is built in the subject and its underpinning epistemological beliefs).
- Content has a significant connection to the knowledge of the teacher, as there may be a need to be flexible to adapt to what is included in the expected content. Ideas about subject content are related to a range of wider concepts in the literature, including subject knowledge and more specific content knowledge, and pedagogical content knowledge (PCK).
- One key tension in defining subjects and their knowledge base is between subject content as something static, against conceptions of it as evolving and dynamic. On the one hand, subjects are defined through formal curricula, examinations, and textbooks, as well as what is published in wider academic fields. These may operate on different timeframes, with ideas in the academic sphere potentially more fluid with ideas evolving and being refined. This connects to wider contextual considerations such as the relationships between school subjects and academic disciplines, challenges associated with uncertainty and what counts as evidence (Wadhwa, Zheng and Cook, 2023[3]), as well as the 'superabundance' of information that is now available to teachers (Botturi, 2019[4]). There is so much information available, and aspects of it change so fast, that 'keeping up' with the subject is a major challenge that teachers face. By adding the term 'quality' to subject content, this pushes ongoing discussions around a subject forward so that rather than accepting content to be taught as a certainty, it gives critical attention to how subject matter is formed and the important decisions that go into it.

Another relevant field of research here has been that into what is often referred to as 'opportunities to learn' (OTL), which refers to the subject matter as it is taught and experienced by students (OECD, 2020[5]). This centres on the idea that what is mandated in a curriculum is moulded by school- and teacher-level decision-making to create an implemented curriculum. This implemented curriculum may differ from the intended curriculum and thus translate into different opportunities to learn for students (Travers and Westbury,

1989[6]). OTL have been found to be a powerful determinant of students' achievement growth (Kuger et al., 2017[7]; Burstein, 1993[8]), as well as their performance in international assessments (Scheerens, 2017[9]; Schmidt and Maier, 2009[10]). Indeed, such opportunities can have a large impact on student achievement both within and between countries (Stacey and Turner, 2015[11]; OECD, 2010[12]).

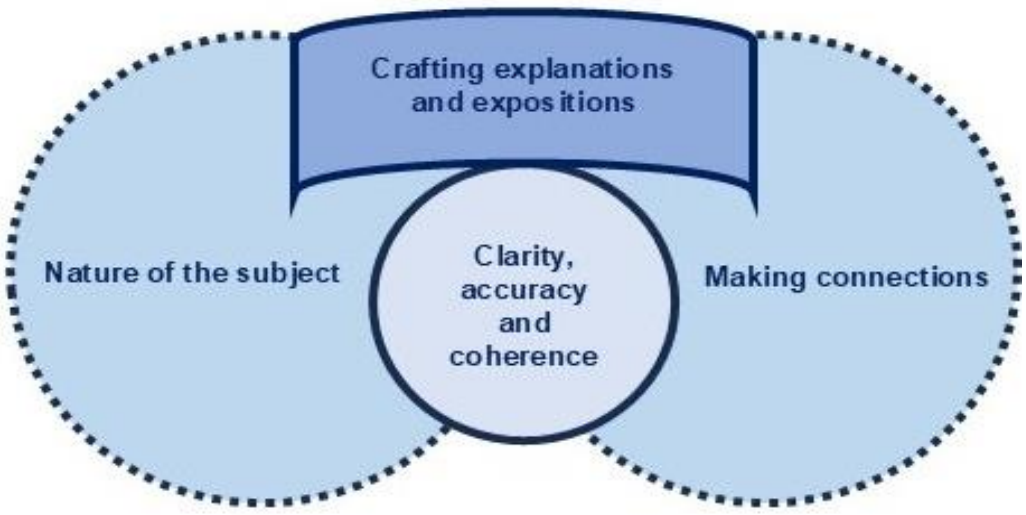
Teaching practices for crafting quality subject content

The pedagogical choices of teachers play an important role in shaping learning opportunities and the content students encounter. Accordingly, these choices also influence students' wider perception of a subject and, more broadly, knowledge that they develop. To foster quality subject content, teachers can make use of the following core practices:

- crafting explanations and expositions
- clarity, accuracy and coherence
- making connections
- nature of the subject.

All of these practices are important and inter-connected, and teachers might draw upon them simultaneously. High levels of clarity, accuracy and coherence are an underpinning feature of quality subject content. This guides how and when teachers craft explanations and expositions that move student understanding forward in a structured and accessible manner. Teachers engage students in going deeper and wider into the subject matter by examining the nature of the subject and making connections. These build a deeper, richer understanding as well as igniting students' own curiosity to explore further.

Figure 3.1. The interrelations across quality subject content practices



Each of these practices are outlined one-by-one below. Each section presents a definition for the practice and other associated terms on how it might also be referred to; key research findings on its impact on student outcomes; main implementation challenges identified by researchers and schools in designing the structure of the activity, task or content, role of students and role of teachers. Then, it looks into the complexity for teachers in monitoring them in the classroom. The final section builds on schools' insights

to provide an indication about the complexities of implementation and provides reflection questions for instructional and school leaders.

Crafting explanations and expositions

There are opportunities for detailed explanations and expositions of ideas or procedures. These are coherent and focused on the deeper features of the topic, including addressing the rationale behind the features of the explanation and how it connects to prior learning. They aim to move students towards being able to meaningfully apply particular ideas or procedures.

The teacher may provide written and/or verbal explanations of what is to be learned or may facilitate students providing explanations. To support students' engagement with explanations, the teacher may make use of modelling or scaffolds to make specific methods or steps clearer.

Associated Terms: *Explaining; Instructing; Explicit procedures and processes; Scaffolding; Modelling or demonstrating; Presenting and communicating new ideas*

Key research findings

The explaining or exposition of content are important parts of classroom interaction (Lachner, Weinhuber and Nückles, 2019[13]). They are a central element of teachers introducing new content to students. As Coe and colleagues (2020[14]) note in their review of research studies and frameworks relating to teacher effectiveness, the presentation of ideas in a clear and well-structured manner is a common feature of several evidence-based frameworks (e.g. Muijs et al., 2018[15]; van de Grift et al., 2016[16]).

There is evidence that detailed, explicit explanations by teachers of the ideas and processes can support students' learning of the subject matter (Stockard et al., 2018[15]). This is paralleled by research that worked examples, such as through so-called modelling, can benefit students when meeting new ideas (Sweller, van Merriënboer and Paas, 2019[16]; Bokosmaty, Sweller and Kalyuga, 2015[17]; Atkinson et al., 2000[18]; Booth et al., 2015[19]). In particular, this process of thinking out loud that occurs through modelling is relevant for students' understanding of how to engage in these deep and detailed thinking processes themselves. Similar ideas have also been described in relation to heuristics (Klauer and Phye, 2008[20]): explaining how problem-solving strategies work, or mental 'shortcuts' that can help with decision-making, can empower students to think across contexts and beyond a specific question or problem. Indeed, building understanding on the underpinning procedures and methods of the subject matter is also significant for students' metacognitive abilities, as students come to not only learn something about the subject, but also learn how to learn more about it (Education Endowment Foundation, 2020[21]).

What are some of the key considerations when implementing?

Structuring: How to present content in an accessible and clear way?

Students are not always equally disposed to engaging in high-quality explanations (Erath et al., 2018[22]). It is important that teachers are mindful of how they support students to engage with new content in a manageable way which challenges students but does not confuse them. Teachers need to consider the content of the explanation, such as the cognitive load it demands and how the information is broken down to align with students' working memories (Sweller, van Merriënboer and Paas, 2019[16]). It is also a question of considering how the content is presented and communicated so that it is clear and comprehensible to students, avoiding superfluous information that may distract or confuse (Coe et al., 2020[14]).

Insights from schools:

> ***Model a live explanation to students in real-time****, especially with new content, where they are walked through the explanation step-by-step at an appropriate pace.*

> ***Break an explanation into clear, organised chunks****, stopping and pausing to take either questions or to let students practise trying this first chunk on their own or in groups. For some content, the explanation should steadily progress adding new layers onto students' understanding.*
>
> ***Build a class glossary of key terms*** *for new vocabulary so students are explicitly introduced to technical language in the subject.*
>
> ***Use artefacts or concrete representations*** *that bring an explanation to life and anchor what is being talked about, such as physical models that can be manipulated or examples that can illustrate a certain idea.*

Students: Are students engaged participants in explanations and expositions?

Students can also play an active role in shaping explanations. This gives students an opportunity to practise articulating their thinking and rationales, a type of deep thinking that can be beneficial for learning (Dunlosky et al., 2013[23]), notably for students with a range of attainment levels (Webb et al., 2021[24]).

Researchers have explored different approaches for encouraging this type of participation, in particular around the idea of students re-voicing contributions to be further refined to move the dialogue towards a fuller, more elaborate explanation (Moschkovich, 2002[25]; O'Connor and Michaels, 1993[26]).

Insights from schools:

> ***Ask one student to write out the explanation and the other students to take on the role of speaking out the rationale for the explanation's step while their peer is writing****, this way the class are asked to essentially provide a commentary on why their peer is writing certain steps.*
>
> ***Call upon a range of students to build an explanation step-by-step****, essentially passing the responsibility around the room to build a 'whole-class' example at the front.*
>
> ***Demonstrate student work through photos, videos or a live visualisation****, for instance showing a model paragraph or a solution to a question where their own hand-written work can serve as a prompt for different students to analyse and explain specific features or steps. This can also demonstrate and celebrate what is possible.*
>
> ***Plan for a clear progression such as the "I do, we do, you do"****, so that the learning moves away from copying what the teacher is doing to more independence of thought and practise.*

Teacher: How to help students understand the rationale behind?

Explanations help students develop an understanding of why a procedure or method is logical (OECD, 2020[5]) which then can help them to use and apply it to new scenarios. Researchers have argued that students benefit from making sense of individual steps in a mathematical procedure or methods (Mishra and Koehler, 2006[27]; Nunokawa, 2010[28]; Ball, 1988[29]). This echoes research in other subjects on making clear to students the rationale behind the tools and procedures that experts in that subject use, such as the ways of thinking of a historian (VanSledright, 2010[30]; Wineburg, 2001[31]) or a writer (Graham, Harris and Santangelo, 2015[32]).

Insights from schools:

> ***Highlight the rationale of procedures clearly for students using annotations****, whether in a written or verbal format, such as explicitly writing or saying "I am doing this step because…"*
>
> ***Expect students to include the rationale of steps****, particularly when only in the early stages of working with new content. Students could write out the 'why' of key steps or speak this out with their peers.*
>
> ***Model examples that have increasingly complex real-world contexts*** *when students are ready, so they can see how a particular explanation applies to a more complex example and how previous information is translated over.*

Clarity, accuracy and coherence

The teaching presents ideas, concepts, tasks and teaching in a clear and coherent manner that is logical for the students to follow.

To support this clarity of understanding, the teaching creates opportunities for students to practise retrieving, using and adapting their knowledge and skills in increasingly variable and complex ways.

The teaching is accurate and free from unintentional or unaddressed errors, and there are no instances of confusion left unaddressed.

Associated Terms: *Presentation of content; Sequencing of content; Practice opportunities; Addressing misconceptions; Rephrasing; Summaries and plenaries; Retrieval; Mastery and embedding*

Key research findings

Reviews and models of effective teaching have consistently found clear, accurate and coherent teaching to be important classroom features (Coe et al., 2020[14]). Research drawing upon student-reported engagement and their perception of teachers' practices has highlighted that teachers' use of practices supporting a well-structured environment are associated with students' behavioural, cognitive and emotional engagement (Hospel and Galand, 2016[33]).

In particular, presenting information in a clear, accurate and coherent manner helps students to build more accurate 'schema' and to avoid picking up errors (McVee, Dunsmore and Gavelek, 2005[34]). The concept of 'schema' is significant; schemas are "a pattern of thought that organises categories of information, and the links between them", and which are stored in the long-term memory" (Education Endowment Foundation, 2021a, p. 49[35]). Developing this more accurate schema contributes to a virtuous cycle in which it is easier for students to critically evaluate and avoid other misconceptions and errors (e.g. Blastland and Dilnot (2008[36]).

This is part of a broader goal of building a high amount of quality knowledge schema, with a range of different studies showing that students with a high amount of knowledge tend to be able to undertake more complex tasks (Willingham, 2009[37]). This is related to understanding the gradual nature of the development of lasting memories, or memory consolidation (McGaugh, 2000[38]), with two particular areas of research important here in terms of teachers' coherent sequencing of content. First, things can be forgotten and lost if they are not used, and thus schema need to be retrieved and used to build mental structures in the long-term memory, but without overwhelming students and impairing performance (Centre for Education Statistics and Evaluation, 2017[39]). Secondly, making aspects of retrieval or using knowledge more 'automatic' can enable the completion of more complex tasks with particular knowledge (Sweller, van Merrienboer and Paas, 1998[40]).

What are some of the key considerations when implementing?

Structuring: How to revisit prior learning?

Prior learning is essential to future learning, and that means that researchers have been interested in how best to activate prior learning. One question has been how to space out the opportunities students have to practise using prior learning again. Students may retain ideas better in their long-term memory if they have a carefully spaced gap between opportunities to retrieve and use prior knowledge (Rogers and Thomas, 2022[41]). This seems to be more effective than just asking students to practise in consecutive days. This is linked to research on the idea of creating what researchers call 'desirable difficulties'; if students have to work hard to retrieve something from their long-term memory, this can help to create a stronger connection in their schema (Willingham, 2009[37]).

Notably, this is connected to a further body of research around how topics may be recalled by encouraging students to practise a mix of problems and tasks, rather than practising the same topic problems in a blocked, sequential manner. Often referred to as 'interleaving' there have been some promising results (Patel, Liu and Koedinger, 2016[42]; Rohrer, Dedrick and Stershic, 2015[43]), though empirical work in typical classroom settings remains nascent and in need of further exploration.

Insights from schools:

> ***Open the lesson with a starter activity that revisits a previous topic****, which can kick students' brains into gear by practising reusing their previous learning, but also serve as a routine, calm start to the lesson.*
>
> ***Consider revisiting a mix of themes from their previous learning*** *– one that was recent, one a bit older, and one from further back – so they move between the topics and practise several different topics.*
>
> ***Collaborate with colleagues on a 'school topic calendar'*** *so everyone can consider how they can revisit certain content or skills that others have been working on. If geography lessons are using statistics and last week mathematics lessons looked at percentages, how can the former strengthen the techniques students have been using in mathematics?*
>
> ***What do students want to revisit and work on?*** *A quick anonymous survey of 'two things from the last month you are unsure on' can flag what the teacher might need to integrate into the sequencing.*

Students: How to ensure students undertake tasks that build fluency and flexibility?

Teachers' decisions around how to sequence content shape the type of practice opportunities and mental connections students build. One area of research has focused on sequencing content for practice but progression too. Often referred to as 'variation theory', this body of work argues that rather than students simply repeating the same subject processes automatically, there should be planned, subtle variations that invite students to think critically about specific content they are considering. Studies have demonstrated the potential value of such approaches to contribute to student learning outcomes (Pang, 2003[44]; Runesson, 2005[45]). Research has primarily concentrated on mathematics, particularly in certain contexts like China and Singapore (Gu, Huang and Gu, 2017[46]; Ling, Chik and Pang, 2006[47]), though theoretical connections have been drawn more widely and there are some case studies in the teaching of drama and science (Lo and Marton, 2011[48]; Nilsson, 2014[49]).

Insights from schools:

> ***Ensure there is some early success for students within the first stages of a topic or lesson*** *before progressing to any variations. Even if small, it helps to build in an opportunity for students, particularly those less self-confident, to feel some progress and ready for a degree of variation with more challenge.*
>
> ***Vary one feature in different ways and keep the others constant****, such as sentence starters (e.g. however, similarly) or one part of a formula in maths and sciences.*
>
> ***Present variations next to each other for comparison****, such as the same sentence with different punctuation or tenses, or a number or function varying in an equation, so students can look across these clearly. Can students try and come up with their own example too?*

Teacher: How to support students' retention of learning through summaries and plenaries?

The use of clear and deep periodic summaries has been conceptualised as an important feature of well-structured classrooms (Seidel, Rimmele and Prenzel, 2005[50]). The explicitness and clarity of the summary is particularly important (OECD, 2020[5]). Summaries and plenaries may occur at any point in a lesson, serving as an opportunity to review and summarise what has been learned. Plenaries are typically associated with the end of a lesson as an opportunity to formatively assess what has been learned. There

is a growing body of recent research on how this type of small, informal and low-stakes 'testing' may be beneficial for students' long-term retention of knowledge (Adesope, Trevisan and Sundararajan, 2017[51]). This points to the fact that summaries and plenaries, are more than simply short lists of points to be read at the end of a lesson, but they can demand students meaningfully think and use what they are learning.

Insights from schools:

> ***Give enough time to plenaries*** *so that students do not feel frustrated and pressured, which may hinder them from showing their real learning level and consequently be of little use to the teacher as a measure of their learning.*
>
> ***Use a variety of formats*** *to avoid too much repetition when it comes to providing summaries, particularly as this may prompt students to translate their knowledge into a different representation.*
>
> ***Challenge students to develop their own summary points*** *first on their own or in groups, and then come together as a class to build a 'final summary' that contains all of the essential information to be taken away.*
>
> ***A class 'learning wall' can be built over the course of lessons****, composed of short summaries of all the major learnings from the lessons. Each student writes their summary and some of these can be added to the wall as students move onto a new topic.*
>
> ***Provide a handout of a student summary for students' reference on each topic****; if there is information that is really essential to learn and master – such as procedures or methods – then after summarising this as a class an example from a student could be chosen for distribution.*

Making connections

There are opportunities to explore and examine the connections that exist in and between subject matter ideas, procedures, perspectives, representations, and experiments. Connections should be explicit, detailed and 'elaborate' to help deepen student understanding, whilst always connecting to what has been previously learnt to ensure coherence.

This may also include students making connections between particular patterns in the content and more challenging abstractions; students may be pushed to make connections that encourage them to generalise from specific examples to broader foundational concepts or definitions.

Students are also encouraged to proactively make these kinds of connections within and between the otherwise discrete subjects that they are learning.

Associated Terms: *Connecting to prior knowledge/learning; Connecting topics; Patterns and generalisations; Abstractions; Interdisciplinary thinking*

Key research findings

Across a range of subjects and contexts, making connections has been shown to be a fundamental aspect of learning, including connections between specific words (Nunes, Bryant and Barros, 2012[52]), and connections between ideas, including as part of building internal mental structures or schema (Centre for Education Statistics and Evaluation, 2017[39]; Education Endowment Foundation, 2021a[35]; McVee, Dunsmore and Gavelek, 2005[34]). In particular, the ability to make clear, specific and explicit connections between ideas in the subject matter has been understood as a key feature of students developing a deeper understanding of the subject (Stigler and Hiebert, 1999[53]).

There has been particular interest in recent years in the field of cognitive science and trying to understand more about the processes of student learning. A recent systematic review of cognitive science approaches in the classroom found some support for the importance and efficacy of making connections in the classroom (Education Endowment Foundation, 2021a[35]). Evidence from the field of neuroscience also echoes these claims from a different perspective, arguing that making connections between different types

of materials, sources and contexts also functions to drive biological changes in the brain through creating new neural connections which in turn builds capacity supporting further learning and recall (Owens and Tanner, 2017[54]). At the same time, there is also need for some caution; making connections demands careful monitoring and consideration, with it also having the potential to cause cognitive overload and be a negative experience for students if they are insufficiently familiar with the content (Education Endowment Foundation, 2021a[35]), pointing to the importance of understanding more about how making connections can be most effective in relation to students' prior knowledge. Similarly, there is a need for more studies in typical classroom contexts. There remains though the potential for the field to yield findings going forward that are highly applicable across contexts (Education Endowment Foundation, 2021b, p. 5[55]).

What are some of the key considerations when implementing?

Structuring: Are connections represented in tangible ways?

Representing connections in ways that are tangible can support students' comprehension of connections as well as their longer-term retention of this. One notable area of research has related to the use of physical and virtual manipulatives (Moyer-Packenham and Westenskow, 2013[56]), which can have positive effects on student learning though seemingly also demand teachers adopt a contextualised approach informed by student needs (Cooper, Sidney and Alibali, 2017[57]). Teachers may also draw upon narratives, with stories being described as 'psychologically privileged' (Willingham, 2004[58]) in part because of the way the form makes connections between information. Mar et al.'s (2021[59]) meta-analysis of the impacts on memory and comprehension related to the use of two types of texts (narrative and expository), leads them to conclude that stories are more readily understood, and also better remembered, than essays.

Insights from schools:

> ***Use flashcards or puzzle pieces that can help students experiment and represent content**, such as creating timelines of events or manipulating words and numbers in expressions.*
>
> ***Turn propositional information into stories and narratives**, such as by bringing in themes of settings, plot and resolution; for instance, accounts of geographical places can become a sequential journey.*
>
> ***Demonstrate 'real-time' changes through software**, such as to model the changes of state or different equations of motion in science.*

Students: Are students engaged in identifying meaningful connections?

Students can also play an active role in making connections in the content matter, as well as between different pieces of content. One area of particular research here has been engaging students in 'mapping', which has shown some promise as a useful approach in a range of contexts (Education Endowment Foundation, 2021a[35]; Gómez Betancur and King, 2014[60]). Sometimes referred to as 'knowledge', 'concept' or 'mind' mapping, the essential activity involves students writing or drawing aspects of the subject matter (e.g. terms, concepts, theories), linking them to show relevant connections that exist, and – crucially – explaining or summarising what the rationale is for the connections. It is important that this takes account of students' prior knowledge and that there is a degree of student familiarity with the material for it to be productive, whilst some teacher guidance may also be needed to help ensure actual engagement with the content rather than surface-level organising of material (Hattan, Alexander and Lupo, 2023[61]; Education Endowment Foundation, 2021a[35]).

Insights from schools:

> ***Seeing a concept map as an evolving log of their learning can help students identify new connections and build a deeper picture**. For instance, revisiting maps to add in recent learning can add an extra layer of learning and mean new connections may be identified.*

> ***Create space for discussing and justifying connections**, such as students providing peer feedback on others' concept maps and asking each other to explain 'why' a connection exists.*

Teacher: How to support students to move from connections to wider generalisations and abstractions?

One feature of making connections is progressing to identify patterns across connections to make generalisations and abstractions from these connections. Across subject areas, this process of wider connection-making and generalisation is an important part of quality subject matter, even if this may look different across subjects (Ball, 1988[29]; Henningsen and Stein, 1997[62]). Teachers can play a role in facilitating this process, with research have documented approaches such as the use of manipulatives in mathematics (Carbonneau, Marley and Selig, 2013[63]) or frameworks for evidence-use and argumentation in science (Shemwell et al., 2015[64]).

Insights from schools:

> ***Encourage students to anticipate what the key concepts or outcomes will be** and then self-assess their predictions at the end of the instruction or demonstration. While relying heavily on their prior knowledge, this method of prediction encourages them to question and understand why a generalisation they made did or didn't work in that specific case.*
>
> ***Challenge students to re-organise their thinking**, such as by redrafting an existing concept map into a new format – they might find new categories to organise things by, and new patterns that exist.*
>
> ***Create a space for students to 'look across' group projects or inquiries**, such as when listening to other groups present their work, students note down similarities and differences across groups' different focuses which can facilitate a whole-class discussion.*

Nature of the subject

There are opportunities to consider the nature of the subject as students engage with the content. This focuses on considering the methods and processes that build disciplinary knowledge in a particular subject. There may be opportunities to consider the types of knowledge that are valued, the role of people in these processes, and the ideas and questions central to a subject.

***Associated Terms:** Disciplinary knowledge; Disciplinary thinking; Communicating purpose; Subject vocabulary*

Key research findings

There is a long history of interrogating the question of what students are being asked to learn (Segall, 1999[65]; Graziano, 2008[66]). In recent years this has seen renewed attention, both from researchers and policy-makers (Mork et al., 2022[67]; Ioannidou and Erduran, 2022[68]); in the face of renewed global challenges that foreground questions around uncertainty (e.g. Lewandowsky, Ballard and Pancost, 2015[71]); questions of equity including who and what types of knowledge are valued (e.g. Ladson-Billings, 2021[72]); and demands for greater skills such as critical thinking in relation to engaging with subject matter (e.g. Scheie, Haug and Erduran, 2022[73]).

There has been particularly rich growth in science education around the nature of science (Erduran and Dagher, 2014[69]). Understanding the nature of science and the epistemic ideas that underpin the subject is viewed as a fundamental part of scientific literacy (Lederman et al., 2013[70]). Small-scale empirical work with teachers has suggested that engaging with learning about the nature of science can support teachers' pedagogy and impact students' understanding of scientific processes including scientify inquiry (Khishfe, 2007[71]; Khishfe, 2013[72]). Similarly, research on inquiry activities linked to subject content suggests they can make aspects of the nature of science more meaningful to students, supporting students to think

critically about the development of scientific knowledge as a human activity (Liu and Lederman, 2002[73]; Chinn and Malhotra, 2002[74]). More broadly, researchers in different fields have drawn attention to the importance of developing students' understanding of the epistemic ideas in their subjects (e.g. Stoel, Logtenberg and Nitsche, 2022[79]) and examined subject-specific procedures for building knowledge, such as historical reasoning (Gestsdottir, Van Drie and Van Boxtel, 2021[75]), or proof in mathematics (Sommerhoff and Ufer, 2019[76]).

There is still a need for more large-scale empirical studies across various fields and the synthesis of their findings to improve classroom implementation, which remains a considerable challenge. Translating knowledge and findings across different subjects is complex, and while social and institutional aspects, such as what counts as knowledge and which sources are trustworthy, are considered across subjects, they are not always coherently conceptualised as the 'nature of the subject'. Some subjects are only beginning to critically examine how knowledge is produced and refined within their fields (Puttick and Cullinane, 2021[77]). Researchers have already noted the existing tensions between teaching aspects relating to the nature of science and the curriculum (Lederman and Lederman, 2019[78]).

What are some of the key considerations when implementing?

Structuring: How to explicitly introduce the subject's 'big ideas' and 'big questions'?

Presenting the big ideas and questions in the subject may help build what is sometimes referred to as 'cultural capital' in the subject. If the nature of the subject is understood as the 'rules of the game' (what counts as knowledge, who is seen as legitimate, and so on), there are strong arguments linking socio-economic background to greater familiarity with the rules of academic knowledge (Chisholm, 2021[79]; Broer, Bai and Fonseca, 2019[80]). Accordingly, it can be valuable to make what can be hidden assumptions about the nature of subjects more explicit. For instance, this has been suggested in research on argumentation in science (Osborne et al., 2019[81]; Kind and Osborne, 2016[82]) and proof in mathematics (Sommerhoff and Ufer, 2019[76]). This connects to wider research documenting that explicit introductions to and explanations of new ideas are an important aspect of teaching more widely (Bokosmaty, Sweller and Kalyuga, 2015[17]; Atkinson et al., 2000[18]).

Insights from schools:

> ***Run a class investigation into the history of a subject to help highlight how knowledge has been built**, which can also be a platform for discussing the strengths and weaknesses, such as biases, in this.*
>
> ***Include the story** behind new content when introducing it, even if briefly, to bring in the wider context – who came up with this model, this theory, this argument, and why has it been important?*
>
> ***Set the 'big question' up for the students to debate**. They often have a view on certain content, and at the end of a module could try and weigh in on the question – such as the cause of a historical event, or the purpose of certain characters in a text.*
>
> ***Bring in the limits of knowledge and unanswered questions in the field**, these ongoing debates or mysteries often connect to the content and can be a way of showing how subjects are 'still alive'.*

Students: How can students think like 'mathematicians', 'scientists' or 'historians'?

Developing an understanding of the subject processes that build knowledge can take time, but students can be scaffolded to develop the critical judgement that characterises subject experts. In the field of history, Reisman (2012[83]) demonstrates how the use of primary sources and engaging with these in similar ways to a historian impacted students' historical thinking and mastery of factual knowledge, with some skills being able to be applied to contemporary issues too. Part of the critical eye that students may develop may also include the question of uncertainty, and the limits of particular knowledge.

Insights from schools:

> ***Role play subject- specific processes**, like a student scientist having to justify their findings to the class, or students interrogating historical figures in a mock court of law.*
>
> ***Train students in using a clear questioning model for interrogating subject evidence as if an expert** – for instance, what are the frequent questions a historian asks of a source, or a mathematician of a proof, or a writer of a paragraph?*

Teacher: What is the role of epistemological and bias questioning?

Considering the nature of the subject can also be a consideration of equity and inclusion. Subjects may have a 'canon' of accepted figures that have helped to build the subject and are who students study today. Some students, particularly disadvantaged students and marginalised communities, may not see themselves reflected in a certain subject (Atkins et al., 2020[84]; Kricorian et al., 2020[85]). It may also encourage stereotypes, for instance that only some people can be mathematicians or musicians (Hadjar and Aeschlimann, 2014[86]; Jaoul-Grammare, 2023[87]; Makarova, Aeschlimann and Herzog, 2019[88]). Accordingly, teachers may explicitly highlight the forces that have helped to build this canon and strive to ensure a diversity of figures in the subject, as demonstrated in research on highlighting the role of women in STEM (Science, Technology, Engineering and Mathematics) (Guenaga et al., 2022[89]; Hughes et al., 2020[90]), and ensuring a diversity of authors or historical figures in literacy and history (Epstein and Gist, 2013[91]; Mansfield, 2022[92]; Elliott et al., 2021[93]).

Insights from schools:

> ***Seeing what people are doing currently**, such as entrepreneurs, artists, scientists who have done something special in that subject, can be a way to bring different stories and people into a subject. These could be examples students find or ones proposed by the teacher.*
>
> ***Focus on the human side of role models or guest speakers**, showing that these are 'normal' hard-working, passionate people that students can emulate.*
>
> ***Involve families in the learning process** by inviting them to share their cultural traditions, stories, and expertise related to the subject matter.*
>
> ***Can students find the missing narrative?** Students can make their voices heard by questioning and proposing the inclusion of more diverse authors, such as female authors in subjects like philosophy and science.*

Observing the effects on students

Sustaining high-quality subject content in the classroom is an ongoing process. It is one that requires monitoring and adaptation in the lesson as learning unfolds. It means that teachers are frequently looking for signals from students to gauge whether their implementation of teaching practices is effective or not. Teachers use their professional judgement in the classroom to perceive and process these signals.

Table 3.1 includes some of the key signals that teachers gather to check whether they have achieved the goal that they had intended when adopting that practice. The signals can be thought of as the short-term, in-class manifestation of the long-term knowledge, skills, values and attitudes that teachers seek to encourage.

- **Knowledge:** Teachers need to discern if students have a solid understanding of the content by recognising if they can explain their reasoning and connect ideas across subjects. This knowledge is robust and accurate, with students able to accurately recall what they have learnt and use it in new situations. Teachers to ensure that students have developed the ability to make increasingly

elaborate but reasoned connections between their knowledge whilst also developing a holistic and comprehensive understanding of the topic itself.

- **Skills:** Teachers need to assess whether students can grasp the core of explanations to advance towards more complex and cognitively sophisticated learning. To do so, students need to be able to apply their learning to new situations and connect different content, whilst being able to self-monitor this process to identify potential errors. Teachers need to ensure students acquire the flexibility to apply their knowledge to different settings, being capable of asking questions to test their understanding and build on it.
- **Values and attitudes:** Teachers need to detect whether students feel their learning progress is solid enough to go further and use follow-up questions to explore new connections. It is key for teachers to know whether students feel they can use their knowledge to make their personal contributions to the field.

Table 3.1. Signals for whether core practices for quality subject content are working in classrooms

	Knowledge	Skills	Values and attitudes
Crafting explanations and expositions	Students understand the rationale for how processes or ideas work. Critical thinking, cognitive flexibility	Students can transfer the content of an explanation to another application themselves.	Students ask follow-up questions about the content to understand more.
	Students participate in explanations sharing clear, detailed justifications. Problem-solving skills	Cognitive flexibility, tolerance for complexity and ambiguity, problem-solving skills	Curiosity, open mindset
Clarity, accuracy and coherence	Students have a clear understanding of the focus content free from errors. Cognitive flexibility	Students can take their learnings and adapt certain features to cater to a new situation.	Students are confident that their learning is progressing in a structured, robust way.
	Students accurately recall key information in detail even after a time delay. Cognitive flexibility	Adaptability, perspective-taking skills, problem-solving skills	Self-awareness, reflective thinking
Making connections	Students can confidently and accurately make connections between key subject matter. Cognitive flexibility	Students can extrapolate from connections to make wider generalisations.	Students are curious to suggest and explore new connections.
	Students understand how to evaluate the strength of connections and their limitations. Perspective-taking skills, critical thinking	Critical thinking, cognitive flexibility, tolerance for complexity and ambiguity	Curiosity, open mindset
Nature of the subject	Students understand through which processes knowledge is typically built in this subject.	Students pose questions as if a subject expert to evaluate their work processes. Self-regulation, perspective-taking skills	Students feel they belong in the subject and could offer valuable contributions.
	Critical thinking	Students can ask critical question of the subject to evaluate the strengths and weaknesses of its knowledge base. Critical thinking, perspective-taking skills	Sense of purpose

Note: The signals are based on the contributions from the Schools+ Learning Circle and have been mapped to the 'transformative competencies' of the OECD Learning Compass in green.

Unlocking the potential to craft quality subject content

The teaching of quality subject content is shaped by the actions of the teacher in the classroom, but it is also influenced by broader actions at the school and system levels. A deeper exploration of the complexity of crafting quality subject content can shed light on ways in which leaders can create more supportive environments for teachers.

For example, classroom composition and professional collaboration can make a difference. It is complex for teachers to provide explanations and expositions for students with diverse learning profiles and varying levels of prior knowledge while minimizing the development of misconceptions. In this context, professional collaboration focused on specific subject issues can be beneficial. Teachers may need to be flexible in how they support students with content, whether in explaining underlying ideas or specific connections between content areas, and how they transfer the responsibility and agency to students to do this themselves. A space for collective professional refinement and reflection can help anticipate and address students' misconceptions whilst ensuring that the content is clear, accurate, and coherent.

Another example is the flexibility of the curriculum and lesson timing, along with teachers' planning time. An overloaded curriculum can prevent teachers from achieving sufficient depth in their explanations and expositions. Additionally, the allocated lesson time may restrict how teachers revisit ideas, practice, and address misconceptions. The planning and sequencing of content are critical for knowledge retention and progression. It requires time and space for teachers to invest in, including collaboratively.

The school's approach to using data to support teaching is also crucial, such as how it assists teachers in identifying areas where students struggle and need more explicit, remedial guidance. The complexity of monitoring students' understanding in real-time during class is significant. Gaps may become particularly apparent as teachers help students make increasingly elaborate connections between content areas, and monitoring systems that can identify these gaps while providing opportunities to address them and build robust and accurate knowledge are critical.

Box 3.2. Schools' strategies to strengthen quality subject content practices

At **Chengdu Shishi Union Middle School** in China, teachers have worked collaboratively to refine the clarity, accuracy and coherence in their English classes by adopting a structured theme-based review process. A lead teacher oversees each theme being reviewed, collaborating with other teachers in their lesson planning and the selection of instructional material. School leaders support the systematic implementation of this practice by observing and evaluating lessons whilst engaging with research to identify further opportunities to refine the implementation of review processes.

At **Agrupamento de Escolas Gil Paes** in Portugal, teachers participate in professional learning to support students to take on the role of geography experts in conducting independent research projects that expose them to the nature of the subject. Teachers attend regular webinars organised by teacher professional learning centres to consider concrete activities that engage students in research tasks, and how to assess students' learning during the process and in their final oral presentations.

At **Hristo Smirnenski Secondary School of Science and Mathematics** in Bulgaria, teachers and school leaders collaborate on designing lessons that support students to make connections across core scientific curriculum content. This approach focuses on working together to craft a careful progression of learning that builds on prior knowledge and ensures alignment of the scientific curriculum across subjects. Teachers also have access to research platforms and pedagogical materials to support them in creating activities that assess students' knowledge across multiple subjects.

To raise student interest, providing teachers with opportunities to develop a strong understanding of learners early on in the year, as well as opportunities to draw on resources beyond the school walls, might be beneficial. These can aid teachers in sparking class interest in epistemological questions related to the nature of the subject, rather than boring them. The school's resources and how these are allocated, as well as the school's connections with other learning environments in the community or beyond, can offer students opportunities not just to think like a scientist or historian but also to act as one.

In navigating the challenge of crafting quality subject content in classrooms, school and system leaders may carefully consider some of the following questions:

- How can school leaders create a whole-school approach to motivate students' reflection around the most topical pressing questions in different curriculum subjects? What activities can be undertaken at the school level to contribute to helping students emulate experts in different fields of knowledge?
- What structures at the school level can support students to see the inter-connected nature of their learning?
- What kinds of professional development can help teachers refine how they make explanations and expositions of content, particularly that which is most complex and vulnerable to misconceptions? How could wider data and assessment inform this?
- What activities can be organised by the school beyond the classroom to develop the capacity of students to give explanations and articulate their reasoning? What kinds of real-world situations that require these skills could be modelled in schools for students to practice?
- How can high-level curricula goals be translated into coherent sequences of work that best build robust understanding of content throughout schooling? How can short-term needs be balanced with a long-term perspective on curricula too?

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Annex 3.A. Summary of considerations and insights for the practices of quality subject

Annex Table 3.A.1. Summary of considerations and insights for the practices of quality subject content

	Structure of the task, activity or content	Role of students	Role of teacher
Crafting explanations and expositions	How to present content in an accessible and clear way? • Model a live explanation, walking through it step-by-step. • Break an explanation into clear and organised chunks. • Build a class glossary of key terms to introduce technical language in the subject.	Are students engaged participants in explanations and expositions? • Ask students to speak out the rationale of an explanation while a peer writes it. • Call upon a range of students to build an explanation step-by-step. • Demonstrate student work through a visualizer.	How to help students understand the rationale behind? • Use annotations to highlight the rationale of procedures. • Model examples that have complex real-world contexts. • Plan for a progression to more independence of thought and practice.
Clarity, accuracy and coherence	How to revisit prior learning? • Revisit the previous topic when opening a lesson. • Revisit a mix of themes from their previous learning. • Collaborate with colleagues on a 'school topic calendar' to revisit certain content and skills. • Understand what students want to revisit and work on.	How to ensure students undertake tasks that build fluency and flexibility? • Ensure early success within the first stages of a topic. • Vary one feature and keep the others constant. • Present variations next to each other for comparison.	How to support student's retention through summaries and plenaries? • Give enough time to plenaries to avoid frustration and pressure. • Avoid repetition when providing summaries with a variety of formats. • Challenge students to build their own summary points. • Build a 'class learning wall' with short summaries of major learnings. • Provide a handout of a student summary for student's reference.
Making connections	Are connections represented in tangible ways? • Use flashcards that help students experiment and represent content. • Turn propositional information into stories. • Demonstrate real-time change through software.	Are students engaged in identifying meaningful connections? • Use concept maps as an evolving log of student's learning. • Create space for discussing and justifying connection.	How to support students to move from connections wider generalisations and abstractions? • Encourage students to anticipate what the key concepts or outcome will be. • Challenge students to re-organise their thinking. • Create a space to 'look across' projects or inquiries.
Nature of the subject	How to explicitly introduce the subject's 'big ideas' and 'big questions'? • Run a class investigation into the history of a subject. • Include the story behind new content. • Set the 'big question' up for students to debate. • Bring in the limits of knowledge in the field.	How can students think like 'mathematicians', 'scientists' or 'historians'? • Role play subject-specific processes. • Train students to use a clear questioning model for interrogating subject evidence.	What is the role of epistemological and bias questioning? • See what people are currently doing to bring different stories into a subject. • Focus on the human side of role models. • Involve families in the learning process. • Encourage students to find missing narratives by proposing the inclusion of authors.

4 Providing social-emotional support

This chapter focuses on providing social-emotional support to students by nurturing a supportive classroom climate and building positive relationships that are conducive to learning. Effective social-emotional support also demands furthering students' social-emotional development by explicitly teaching and actively practising social-emotional skills with students, which adds a new layer of complexity for teachers to navigate.

In Brief

- Social-emotional support focuses on nurturing the conditions for students to thrive in the classroom, and beyond.
- Classrooms that are socially and emotionally supportive have been associated with higher assessment outcomes, as well as higher non-cognitive outcomes like motivation to learn.
- To provide social-emotional support, teachers can make use of the following practices:
  - nurturing a supportive classroom climate
  - relationship building (teacher-student)
  - relationship building (student-student)
  - explicitly teaching and actively practising social-emotional skills.
- The complexity of social-emotional support hinges upon creating both explicit time and space to create the foundations for this support, as well as regular opportunities to build on these foundations over time.
- To monitor the effectiveness of social-emotional support, teachers attend to signals such as their observation of students' willingness to take risks without fear of mistakes, or students independently using strategies to manage relationships and resolve disagreements.
- The broader school environment shapes how teachers navigate such complexity and effectively implement practices. For instance, the wider school ethos and its norms for healthy interactions influence the climate of individual classrooms, whilst students' social-emotional skill development may be shaped by how a shared language and understanding of skills is nurtured across the whole school.

Understanding social-emotional support

Social-emotional support focuses on nurturing the conditions for students to thrive in the classroom, and beyond. It seeks to meet the social-emotional needs of students which are essential for effective learning, whilst simultaneously facilitating students' development of a holistic set of skills often referred to as 'social-emotional skills'.

Classrooms are fundamentally spaces of human interaction and connection. Humans learn through social interaction, with social competencies arising in early infancy and forming the foundation for brain structure and pathways that enable students to develop socially and cognitively (Kuhl, 2011[1]; Wass, S. et al., 2018[2]). At the same time, learning can be a challenging process and one where students can feel exposed and vulnerable, particularly in a social, interactive space such as a classroom (OECD, 2020[3]).

The impact on student outcomes

Classrooms that are socially and emotionally supportive have been associated with higher assessment outcomes (Allen, J. et al., 2013[4]). For instance, examining a short-term longitudinal sample of more than 1000 participants, Wang and Holcombe (2010[5]) found that features pertaining to students' perceived level of care and support from teachers were positively associated with students' academic grade point averages. Similar findings have been consistently documented in evidence reviews from both research in education (Wang and Degol, 2015[6]) and human development (Cantor et al., 2019[7]). Furthermore, a

positive classroom climate have also been associated with higher motivation to achieve (Patrick, Ryan and Kaplan, 2007[8]), and more motivation to engage in school (Wentzel, K. et al., 2010[9]; Wentzel, 2012[10]).

The nurturing of students' social-emotional skills can support learning and have wide-ranging impacts. There has been considerable growth in research and empirical studies around the role that skills such as students' capacity to self-regulate plays in their learning skills (Immordino-Yang, Darling-Hammond and Krone, 2019[11]; Education Endowment Foundation, 2021b[12]). In addition, social-emotional skills have been found to contribute to school adjustment, socialisation with peers and teachers, and engagement with educational materials (Domitrovich et al., 2017[13]; Nakamichi, Nakamichi and Nakazawa, 2019[14]), as well as impacting students' engagement with problem behaviours such as bullying or inter-personal violence (Durlak et al., 2011[15]).

Evidence has increased with regard to understanding the malleability of social-emotional skills and how they can be explicitly taught. Skills can be malleable, to varying extents, across life (Cantor et al., 2019[7]; Kankaraš and Suarez-Alvarez, 2019[16]), though early childhood is typically viewed as one of exceptional neuroplasticity and skill malleability (Cefai, Bartolo and Cavioni, 2018[17]). That is not to say that the process of skill development 'finishes'; rather, a developmental approach of increasing sophistication is often advocated (Steponavičius, Gress-Wright and Linzarini, 2023[18]; Denham, 2018[19]). Middle and late childhood are also periods of change, while, due to recent research, adolescence is now viewed as a highly sensitive development period too (Yeager, 2017[20]; Immordino-Yang, Darling-Hammond and Krone, 2019[11]). There has, in particular, been increased attention on the distinction between what is malleable and what is teachable (Jones et al., 2019[21]). A recent evidence review by the OECD (Steponavičius, Gress-Wright and Linzarini, 2023[18]), including multiple meta-analyses of social-emotional learning interventions around the world, suggested that social-emotional skills can be taught in school settings across age groups and national contexts. The review found that there was variation in impact, however, depending on the implementation and context. Furthermore, not all social-emotional skills can be considered equally teachable. Of the 23 skills examined in the review, evidence on their teachability was robust for 12 of the 23 skills but moderate, limited or unclear for 11 of them. Empathy, metacognition, co-operation, self-control, assertiveness, stress resistance, emotional control, social problem-solving and self-efficacy appeared as the most teachable skills.

Box 4.1. Notable debates and definitions

- There is no single definition for social-emotional skills, with several different major frameworks existing (e.g. CASEL (Collaborative for Academic, Social, and Emotional Learning), the HEXACO personality inventory. For a summary see Steponavičius, Gress-Wright and Linzarini, (2023[18])). However, there is reasonable consensus that there are five broad domains of skills in alignment with the so-called "Big Five" model of personality traits (OECD, 2021[22]). Thus, whilst still an area of ongoing research and debate, several studies have found that social-emotional skills exhibit conceptually meaningful relationships with this model's five domains of personality traits, suggesting that the five domains can serve as a good overarching framework for organising social-emotional skills (Steponavičius, Gress-Wright and Linzarini, 2023[18]). Accordingly, the OECD's Social-Emotional Skills Survey (2021[22]) focuses on the following five domains based on the "Big Five" model: Open-mindedness: including curiosity, tolerance and creativity. Task performance: including responsibility, self-control and persistence. Engaging with others: including sociability, assertiveness and energy. Collaboration: including empathy, trust and co-operation. Emotional regulation: including stress-resistance, optimism and emotional control.
- A particular underlying challenge in the field is the so-called "jingle-jangle fallacy" which sees the same terminology for different constructs or vice-versa, different terminologies for the same construct (Steponavičius, Gress-Wright and Linzarini, 2023[18]).
- The acquisition of particular skills, often referred as "social-emotional learning", is considered in more detail in the practice Explicitly teaching and actively practising social-emotional skills. However, targeted social-emotional support interventions, which may also be an effective way to support particular pupils (Jones and Bouffard, 2012[23]), are not considered in this chapter.
- A significant amount of research comes from bespoke programmes which may make use of specific resources, curricula or tools, and involve external training, support or cost. Also, many of these programmes are often characterised by whole-school implementation.

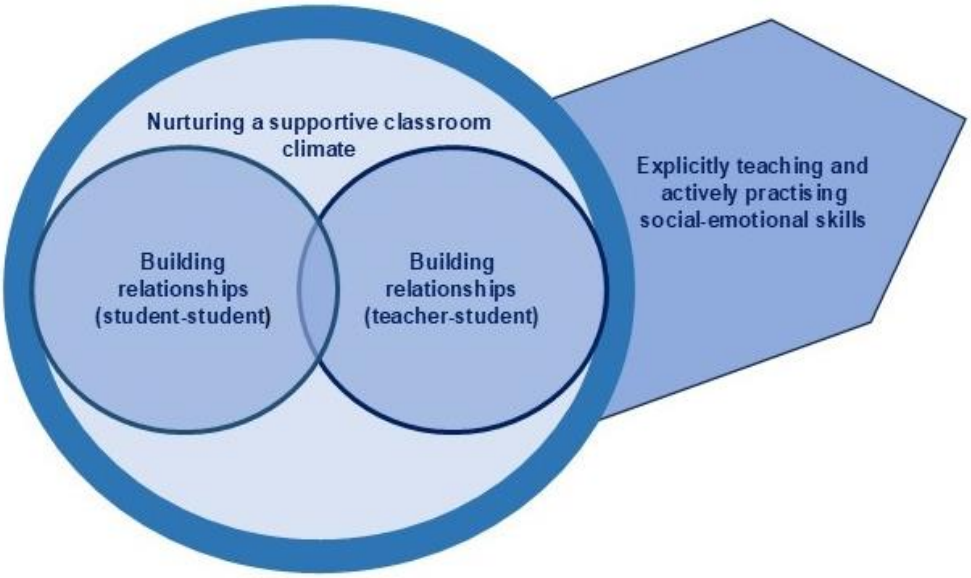
Teaching practices for providing social-emotional support

Learning is a challenging and unpredictable process for students. Students' relationships and emotional states can also vary, informed by what happens in the classroom and wider school, as well as at home. To foster social-emotional support, teachers can make use of the following core practices:

- nurturing a supportive classroom climate
- relationship building (teacher-student)
- relationship building (student-student)
- explicitly teaching and actively practising social-emotional skills.

All of these practices are important and inter-connected, and teachers might draw upon them simultaneously (Figure 4.1). Teachers take intentional actions to constantly nurture a classroom climate conducive to learning. This climate is supported by the relationships in the room; not only do teachers build individual relationships with each student, but they also facilitate positive relationships among students. Additionally, teachers may attend to the specific social-emotional skill growth of students; teachers create the opportunities to explicitly teach and actively practise particular social-emotional skills to enhance students' social-emotional development.

Figure 4.1. The social-emotional practices are interrelated



Each of these practices are outlined one-by-one below. Each section presents a definition for the practice and other associated terms on how it might also be referred to; key research findings on its impact on student outcomes; main implementation challenges identified by researchers and schools in designing the structure of the activity, task or content, role of students and role of teachers. Then, it looks into the complexity for teachers in monitoring them in the classroom. The final section builds on schools' insights to provide an indication about the complexities of implementation and provides reflection questions for instructional and school leaders.

Nurturing a supportive classroom climate

The classroom environment creates a sense of physical and psychological safety for students. This environment is one of mutual respect and warmth towards each other, where students feel secure and confident to take risks in their learning and to share their thoughts and struggles.

Students are supported to persist through challenges and to embrace a mindset orientated towards growth and learning.

Associated Terms: *Learning environment; Warmth; Nurturing; Positivity; Respect; Social climate; Safety and security; Mindsets; Expectations*

Key research findings

Numerous studies highlight the significant impact of classroom climate on various academic and social domains. For instance, a recent meta-analysis of studies found that positive classroom climates had significant impacts on student achievement and social outcomes (Wang, M. et al., 2020[24]). In a large-scale study with 820 first grade classrooms (e.g. 6- to 7-year-olds) in the United States, researchers found that students in classrooms with high-quality climates – those with emotionally supportive teachers who provided thoughtful, warm feedback – displayed greater social competence compared to students in classrooms marked by low emotional support and low-quality instructional feedback (Wilson, Pianta and Stuhlman, 2007[25]).

Research has sought to understand the factors that shape the classroom climate. Researchers have identified both pedagogical practices (e.g. how teachers manage instructional time and activities) and structural components (e.g. classroom management) that contribute to a positive classroom climate (Khalfaoui, García-Carrión and Villardón-Gallego, 2021[26]). Within this context, research has particularly focused on the interactions and communications of the teacher, and their potential to craft a warm and encouraging environment. This has included research into how these types of messages from teachers may advance equity, such as encouraging engagement from underrepresented groups in various fields, like science, technology, engineering and mathematics (Master, 2021[27]) or how teachers have the potential to support mindset shifts for the most vulnerable students (Yeager, D. et al., 2022[28]).

Less attention has been placed on out-of-classroom contexts, such as playgrounds or corridors (Jones and Bouffard, 2012[23]). These are spaces where interactions and relations are often less regulated and 'seen' by teachers. They are spaces where students may feel particularly vulnerable and that play a particularly large role in shaping the wider learning environment and experience in classrooms (Jones, S. et al., 2021[29]).

What are some of the key considerations when implementing?

Structuring: How to build a sense of safety and belonging?

The climate should be one where students feel safe and that they belong (Allen and Bowles, 2012[30]; Allen, Vella-Brodrick and Waters, 2016[31]). This includes both feeling physically safe with their basic needs being met, and feeling emotionally or intellectually safe to learn, try the work, and make mistakes. Students should also feel that they are a valued member of the classroom, whatever their identity or background, where high levels of mutual respect are shown to all, always.

Insights from schools:

> ***Establish and periodically revisit expectations*** *so they are embedded, such as using them as a tool for self-evaluation or for student reflection when managing low standards of behaviour.*
>
> ***Reiterate that mistakes are welcome****, such as by highlighting moments where mistakes have been helpful for learning or modelling examples, whilst also addressing behaviour that mocks mistakes.*
>
> ***Tackle inappropriate, disrespectful comments head on –*** *if they come up, even said casually or 'jokingly' by students, take the time in a lesson to draw attention to them and deal with them, using it as a learning opportunity to highlight why it is inappropriate.*
>
> ***Undertake a whole-class challenge*** *where students have a responsibility to collectively improve something in the school, community, or just their classroom, where the effects can be tangibly felt (e.g. reducing class waste, improving the displays, volunteering).*

Students: Do students exercise agency in shaping the classroom climate?

Providing students with agency and choice can take a range of different forms. Research suggests that autonomy supportive practices can promote student engagement and persistence (Ma, 2021[32]; Michou, A. et al., 2023[33]; Parker, J. et al., 2021[34]). Teachers may seek to elevate the voice of students in shaping the type of learning environment they are part of, as well as students' role in sustaining this (Reeve, 2016[35]).

Insights from schools:

> ***Co-develop with students a real, concrete outline of the class's expectations at the beginning of the year*** *– for instance, how do they feel the classroom community should interact? What are the behaviours they do and do not expect to see in their classroom?*

> ***Provide opportunities to hear student voices around how they feel in the classroom****, such as a task that can help reveal their well-being.*
>
> ***Give students responsibility for monitoring the space and resources,*** *particularly those who are exhibiting more challenging behaviours. Clearing up, distributing, setting up, organising transitions, such routines can all be a vehicle for students play an active role in fostering the productive classroom climate.*
>
> ***Give students occasions to make decisions on how potentially stressful situations unfold****, such as around choosing an oral or written presentation.*

Teacher: Is praise and encouragement provided in a careful manner?

Research indicates that praise is one significant way teachers communicate their views of intelligence and ability to students. Research has found out that teachers with high expectations of their students, within contexts of supportive, growth-oriented messaging and practices about the malleability of students' potential, facilitate student motivation and engagement (Reyes, M. et al., 2012[36]). In contrast, when students are praised in ways that emphasise innate abilities, such as being 'smart', they seek out fewer challenges, persist less on difficult tasks, have a more pronounced fear of failure, and less academic motivation (Cimpian, A. et al., 2007[37]; Dweck, 2007[38]; Dweck, 2016[39]).

It is important to note that praise need not be confined to academic matters but can also be a way of reinforcing expected behaviours; praise may also be used to reinforce positive behaviours and to draw attention to actions that are important in the classroom (e.g. kindness, help). Again, it still requires careful, thoughtful use even with a wider focus on behaviours.

Insights from schools:

> ***Be sincere and balanced****, avoiding the extremes of either never or always providing praise, or giving vague or over-the-top praise. Rather, navigate the middle ground of providing authentic praise at appropriate, deserved times that celebrates effort and encourages more of it.*
>
> ***Focus praise on specific examples from student work and the particular learning goals,*** *such as the quality use of particular processes or approaches that students are working on, as this is where students develop the skills that transfer across content – the deep problem-solving and out-of-the-box thinking, as well as the wider skills of dedication and persistence.*

Relationship building (teacher-student)

Relationships between teachers and students can be positive, supportive, and even warm. The teacher creates opportunities to listen to students and hear their thinking, and is approachable to students.

When the teacher interacts with students, these interactions can be caring, attentive and responsive, enriched with question-asking and individualised attention. The teacher is consistent in their interactions with all students.

Associated Terms: *Interactions; Positivity; Respect; Warmth; High expectations; Consistency; Authenticity*

Key research findings

Decades of research shows that students who develop positive, high-quality relationships with their teachers experience greater academic and social success throughout their lives (Alzahrani, Alharbi and Alodwani, 2019[40]; Guay, 2022[41]; Spilt, Koomen and Thijs, 2011[42]; Wentzel, 2022[43]). High-quality teacher-student relationships are salient predictors of learning, academic success, and social-emotional adjustment to the classroom environment (Ansari, Hofkens and Pianta, 2020[44]; Hughes, J. et al., 2008[45]). This is relevant across student ages. For instance, a longitudinal study of 2 079 high school students found

that positive teacher-student relationships were significantly associated with increased student engagement in school (Martin and Collie, 2019[46]). In contrast, a landmark study by Hamre and Pianta (2001[47]) evaluated teacher-student relationship quality for a large sample of students from kindergarten through eighth grade, and found that negative relationships in kindergarten predicted poor academic and behavioural outcomes by eighth grade.

High-quality teacher-student relationships are seemingly of particular importance for certain students. They may be especially beneficial for children at higher risk of developing maladaptive behaviours - high-quality relationships with teachers are positive agents of change (Baker, Grant and Morlock, 2008[48]; Hamre and Pianta, 2005[49]; Liew, Chen and Hughes, 2010[50]; McGrath and Van Bergen, 2015[51]). There is also some important subject-specific evidence; teenagers interest and confidence in STEM (Science, Technology, Engineering and Mathematics), for example, tends to falter in adolescence and quality relationships can be significant for addressing this (Fredricks and Eccles, 2002[52]; Simpkins et al., 2019[53]).

What are some of the key considerations when implementing?

Structuring: How to make time for individual students?

Research suggests that teachers who make time for individual students cultivate stronger inter-personal connections with them (Dong, Liu and Zheng, 2021[54]) and strengthen classroom community (Rogoff, B, Turkanis and Bartlett, 2001[55]). Being well-informed about students is also essential for understanding potential negative behaviour of students that can naturally arise in school settings, and for working productively to address this (Sammons et al., 2016[56]). Moreover, there are promising findings that simple interventions like making time to greet students may be proactive measures for promoting a positive learning environment too (Cook et al., 2018[57]).

Making time for individual students is also a key aspect of making classrooms equitable, by providing teachers with the means to better respond to diverse student needs (Ferguson-Patrick, 2020[58]; Immordino-Yang, Darling-Hammond and Krone, 2019[11]; Cantor et al., 2019[7]). Students should feel comfortable to share who they are and create meaningful connections with their teacher, with these types of cumulative, reciprocal interactions playing a role in students' feelings of belonging at school (Allen, Vella-Brodrick and Waters, 2016[31]; Allen et al., 2021[59]).

Insights from schools:

> ***Consider using more open-ended activities at the start of the lesson****, such as a group problem-solving challenge or a thought-provoking question, which allow the teacher to circulate and speak more with students.*
>
> ***Ask open-ended questions in lessons that encourage opinions and reflections****, which may invite students to elaborate on topics and connect them to their perspectives, interests and personality.*
>
> ***Give students agency to develop a piece of work where they share who they are****, such as a homework project at the start of a year presenting their passion, family history, or heroes.*
>
> ***Create opportunities for occasional, quality one-on-one talks*** *with students about their passions and goals and how they connect to learning. These could be organised in a lesson when other students are immersed in activity, or outside of lessons.*

Students: Do students feel they are treated fairly?

Students can have a heightened awareness of fairness, with adolescence in particular characterised by a heightened sense of self-consciousness as well as sensitivity to their relationship with peers (Blakemore and Mills, 2014[60]; Yeager, Dahl and Dweck, 2018[61]). Treating students differently or inconsistently may communicate mixed messages to students, suggesting that the teacher has lower expectations of them or that they are less valued than others. This could have ramifications for students' confidence and their

identity, or contribute to poor behaviour (Mameli et al., 2018[62]; Donat et al., 2015[63]). Indeed, consistency in terms of expectations and boundaries is repeatedly identified as a key feature of promoting positive behaviour (Sammons et al., 2016[64]; Coe et al., 2014[65]).

Insights from schools:

> ***Being 'firm but friendly' is the goal whenever a student*** *has over-stepped the line of what is expected in terms of behaviour, it means all interactions remain respectful and no student feels they are being labelled negatively.*
>
> ***Explain why you have taken decisions****, not to negotiate a decision but so that students can understand the rationale behind it. For instance, if there is a need to sanction negative behaviour, it should be clear why that is the case.*
>
> ***Self-monitor interactions*** *by keeping track of who you haven't managed to properly engage with.*

Teacher: How to repair and restore relationships?

Instances of poor behaviour that place relationships under strain are an inevitable reality of teaching. The need to address challenging behaviour or disruption can vary considerably across contexts (OECD, 2019[66]), but is a consistent and important feature of teaching and the tools teachers need at their disposal (van Tartwijk and Hammerness, 2011[67]; Muijs and Reynolds, 2000[68]). This is unsurprising considering the aforementioned complexity of student development as well as the challenges that students' wider lives and experience may bring (Cantor et al., 2019[7]). Teachers, accordingly, need to be able to potentially repair and restore relationships to allow them to return to being positive influences on students and their learning (Cook et al., 2018[57]; Kincade, Cook and Goerdt, 2020[69]).

Insights from schools:

> ***Ensure that the student has some time or space to 'cool off'*** *if there has been a moment of conflict in the relationship, so emotions can be regulated and brought under control.*
>
> ***Reiterate the fundamental care and high expectations*** *you have for a student, so they know that their relationship with you is important.*
>
> ***Discuss constructively*** *what can be done differently in the future, to avoid a repeat of previous misbehaviour or misunderstandings, and set a clear expectation or goal what both you and the student are going to do.*
>
> ***Be honest and open*** *around your own role in a negative interaction if something should have been handled differently. By taking responsibility for certain aspects, you can invite the same from a student.*

Relationship building (student-student)

Student-to-student relationships can be characterised by a culture of mutual respect and open-mindedness. Students have opportunities in the classroom to connect with one another, to communicate, collaborate and interact with their different peers.

Teachers are mindful of the social dynamics in the classroom and support healthy relationships between all students.

Associated Terms: *Respectful relationships; Pro-social behaviour; Kindness; Trust; Community; Co-operation; Code of conduct; Restorative justice*

Key research findings

Research has found that peer relationships among students impact students' academic success and the attitudes that they develop about school (Ladd, Ettekal and Kochenderfer-Ladd, 2017[70]; Glew et al.,

2005[71]; Young-Jones et al., 2014[72]). Classrooms characterised by rich positive ties between students, as well as more egalitarian relationships than social hierarchy, can have better behavioural and academic outcomes (Gest and Rodkin, 2011[73]). For instance, a large-scale, longitudinal study by Tufts University found that positive peer relationships in grades 6 to 8 significantly boosted academic and emotional engagement, while negative behaviours like bullying were linked to decreased school engagement (Li, Y. et al., 2011[74]). There may also be wider benefits in terms of the skills students learn; Kilday and Ryan (2022[75]) emphasise that peer relationships provide social support and opportunities to learn features of socialising.

Recently the key, if often subtle, role of the teacher in shaping student relationships has become clearer. Research has demonstrated that teachers can play an important, "invisible" role (Farmer, McAuliffe Lines and Hamm, 2011[76]) in facilitating healthy peer interactions in the classroom. Teachers who make an effort to help manage peer relationships can have a positive impact on how peers interact with each other (Kilday et al., 2022[77]; Gest et al., 2014[78]). There is also evidence on the role that whole-school approaches play, which may be particularly effective rather than single, isolated classroom approaches (Clarke, A. et al., 2015[79]; Cefai, Bartolo and Cavioni, 2018[17]).

What are some of the key considerations when implementing?

Structuring: How to design for positive interactions?

Group activities, which give students more space for building and managing relationships, as well as activities in which student roles are more fluid as both learners and teachers for one another provide opportunities to create an environment with more positive peer interactions (Qiu and Moll, 2022[80]) and more open attitudes and beliefs amongst students (McDuffie, Mastropieri and Scruggs, 2009[81]; Solone, C. et al., 2020[82]).

Insights from schools:

> ***Invest a good amount of time at the start of the year*** *in opportunities for students to interact with each other, such as with time to learn about each other and team-building exercises, which can pay dividends in the long-run.*
>
> ***Create opportunities for collective achievement and celebration****, as this may create a greater, more sustained sense to student collaboration.*
>
> ***Draw attention to relevant connections between students****, like mutual interests or similarities that students may not be aware of.*
>
> ***Be conscious of dynamics and tensions between students*** *and ensure that seating plans are practical; if two students really struggle to work together then it may be counter-productive to force them to work together all of the time.*

Students: Do students know how to manage their relationships?

Teachers may support students to manage peer relationships in a way that supports students' own self-efficacy (Ryan, Kuusinen and Bedoya-Skoog, 2015[83]). This can give students the responsibility and agency in promoting healthy relationships, which is significant for both their own acquisition of skills but also for the sustainability of the peer interactions in the classroom. Of particular relevance here is students' management of the inevitable strains in relationships. Teachers may facilitate the acknowledgement of conflicts and aiding students in conflict resolution (Kilday et al., 2022[77]).

Insights from schools:

> ***Acknowledge and troubleshoot conflictual situations as a class**, for instance by discussing how a situation can be addressed so that students learn to engage and reflect on each other viewpoints and what are healthy ways of communicating them.*
>
> ***Ask students to notice group dynamics that can naturally arise** (e.g. interrupting or dominating, anchoring ideas, coasting) and reflect upon how to address these – such as creating space for more timid, quieter peers to engage, or motivating disengaged peers.*

Teacher: What types of communication and behaviours can promote positive relationships?

The language and behaviour that teachers model in the classroom is important for conveying how the teacher expects interactions in the classroom to be respectful and positive (Farmer, McAuliffe Lines and Hamm, 2011[76]). For instance, research finds that teacher acceptance and respect of students impacted how students interacted with each other (Chang et al., 2007[84]). Similarly, research shows that teachers who encourage pro-social actions, like sharing or offering help, in socially interactive environments have students who engage in more pro-social behaviours (Spivak and Farran, 2012[85]).

Insights from schools:

> ***Set clear expectations about the tone for interactions to ensure that these are in a calm, polite, respectful way** to reinforce how and why students should be respectful.*
>
> ***Model active listening strategies**, drawing attention to students to what you are doing to really engage with what someone else is saying and to understand their point of view.*

Explicitly teaching and actively practising social-emotional skills

Social-emotional skills are explicitly taught to students in a focused and sequenced way to build their understanding of these skills. This includes teaching students about how they can self-regulate these skills. Students have active opportunities to use this knowledge and practise these skills in a way that is integrated with their broader learning.

Skills are sensitive to students' age and development. Skills may encompass particular attitudes, behaviours or competencies.

***Associated Terms:** Social-emotional learning; Communicating emotions; Emotional intelligence; Self-regulation; Lifelong learning*

Key research findings

Social-emotional skills are be malleable and not simply innate and fixed (Steponavičius, Gress-Wright and Linzarini, 2023[18]). They can be systematically targeted through programmes (Clarke, A. et al., 2015[79]) and adjustments to classroom teaching (Durlak et al., 2011[15]). Numerous reviews of impactful programmes and interventions on social-emotional learning have consistently identified the explicit teaching and practising of social-emotional skills as a common feature of effective programmes (Jones, S. et al., 2021[29]; Clarke, A. et al., 2015[79]; Durlak et al., 2011[15]). These can help to make social-emotional skills development a clearer, more purposeful and integrated feature of classrooms (Jones and Bouffard, 2012[23]).

There is also an important equity consideration. Whilst the evidence is still developing as not all studies consider different sub-groups (Clarke, A. et al., 2015[79]), particular benefits of explicitly teaching and practising social-emotional skills have been reported for some students (Jones and Bouffard, 2012[23]). Research in the United States has found that it is particularly important for children from low-resourced communities, who often enter formal schooling with lower skills in executive functioning (Blair and Raver,

2012[86]) compared to their highly resourced peers, to have opportunities in school to develop social-emotional skills. It has been well argued that adversity and poverty may considerably hinder brain development (Cantor et al., 2019[7]), and that these can partly explain later differences in achievement gaps (Distefano et al., 2021[87]; Zelazo and Carlson, 2020[88]).

Of particular interest in recent years has been explicit attention to growth mindsets in classrooms and schools. Recent meta-analytic research suggests growth mindset interventions over the past decade still need further rigorous evaluation and implementation (Macnamara and Burgoyne, 2022[89]). In particular, there is a need to understand their differential impacts across age groups (Park et al., 2020[90]) and individual differences (e.g. What works best for who? What works best at what age?) (Leonard and Woodland, 2022[91]), and diverse populations (Burnette et al., 2023[92]).

More broadly, for those aged 10-14 the results of social-emotional programmes are mixed, but for older students there is particularly limited evidence on the effectiveness of teaching of social-emotional skills (Yeager, 2017[20]; Rosen et al., 2022[93]).

What are some of the key considerations when implementing?

Structuring: How to introduce specific skills and strategies to students?

Jones and colleagues (2021[29]), who examined a range of studies that were evidenced through either randomised control trials or multiple studies, found that direct and explicit instruction was a common feature of effective programmes and interventions focused on teaching social-emotional skills. This manifested in a range of ways, such as referencing particular skills, introducing or explaining skills, or considering how to apply particular skills.

Insights from schools:

> ***Build a clear, shared language for talking about social-emotional skills**, including definitions and examples of what they may look like when they manifest in classrooms. For example, what does 'open-mindedness' or 'emotional regulation' really mean for a student and look like?*
>
> ***Bring in the 'why'** behind the teaching of a skill, such as what it is trying to address if a student has been struggling (e.g. stress resistance for anxiety) or the bigger picture goal in terms of why it matters for the future (e.g. co-operation).*
>
> ***Highlight and celebrate examples of the skills in action in the classroom**, so that students can see what these skills look like in real-life.*

Students: Do students have regular, integrated practice opportunities to use different skills?

As well as explicitly explaining particular skills or modelling them, teachers should also consider how they provide opportunities for students to actively try out different skills and practise using particular strategies that they learn about. These opportunities can be particularly impactful when they occur in a sustained, regular way, integrated alongside the content they are learning (Diamond and Lee, 2011[94]; Sanchez et al., 2018[95]). Reviews of interventions such as positive behavioural interventions and supports have suggested that a lack of intensity in certain targeted interventions and a lack of embedding in daily, everyday interactions may hinder their effectiveness (Jones and Bouffard, 2012[23]). The regularity of different practice opportunities may be particularly relevant when there is ongoing debate about how 'domain specific' certain skills are and how easily they can be transferred to different subjects or tasks (Lamb, Maire and Doecke, n.d.[96]).

Insights from schools:

> ***Tie the use of certain skills and strategies to the subject matter to give it context and meaning**, highlighting to students the skills that they have had to use in a particular task – for example, how empathy may be used in literacy when reading a text, or in geography when conducting field work.*
>
> ***Build a consistent routine that encourages students to self-monitor their development of social-emotional skills**, where they reflect not only on the content, but also how they've improved particular skills in that learning context.*

Teacher: Can skills or strategies be directly modelled by the teacher?

Teachers can help to make skills, and associated behaviours or strategies, more explicit and clear to students by directly modelling these. Researchers have argued that it is important for teachers to model the same skills that they are encouraging students to learn about and use (Jones, S. et al., 2021[29]; Sutherland et al., 2019[97]). This echoes research in relation to the modelling and demonstration of growth behaviours by teachers and how these can help these ideas to take root and develop in students too (Yeager, D. et al., 2022[28]).

Insights from schools:

> ***Highlight when you as the teacher use the same skills**, such as handling the frustration of a problem-solving process or when we feel anxious and stressed, and the strategies that can be deployed in these situations.*
>
> ***Participate in the skill-learning too and provide your own reflections**, like students do, on the use of certain skills in the lesson. For instance, on what could have gone better when say collaborating with students or trying to manage a certain task.*

Observing the effects on students

The core practices of social-emotional support demand an ongoing investment of time, to both establish and sustain the levels of support students experience. It means that teachers are frequently looking for signals from students to gauge whether their implementation of teaching practices is effective or not. Teachers use their professional judgement in the classroom to perceive and process these signals. Table 4.1 includes some of the key signals that teachers can gather to check whether they have achieved the goal that they had intended when adopting that practice. The signals can be thought of as the short-term, in-class manifestation of the long-term knowledge, skills, values and attitudes that teachers seek to encourage.

- **Knowledge:** students understand the value of classroom norms, expected roles, and are able to label their emotions.
- **Skills:** students independently engage in positive interactions and successful peer collaboration. They also exert agency in managing their needs and their learning, including by being able to set their own goals or asking for support.
- **Attitudes and Values:** students are able to publicly share their understanding and facets of their authentic selves, and show empathy and care when others do so, or when they demonstrate particular needs. They show openness to further developing their skills.

Table 4.1. Signals of socio-emotionally supported students in classrooms

	Knowledge	Skills	Values and attitudes
Nurturing a supportive classroom climate	Students understand the expectations and norms for the classroom and actively uphold these.	Students actively listen to one another and are respectful of each other's ideas or perspectives.	Students are willing to take risks without fear of mistakes.
			Open mindset
	Integrity, responsibility [towards others], self-awareness	Respect, responsibility [towards others]	Students encourage one another including through setbacks.
			Empath, compassion
Relationship building (teacher-student)	Students understand who their teacher is as a person from actively listening to their interactions with the teacher.	Students can seek out the support and guidance of the teacher at appropriate moments.	Students are comfortable to share their background, interests and aspirations with the teacher.
	Trust, empathy	Self-regulation, locus of control	Trust
Relationship building (student-student)	Students understand how to use strategies to manage relationships and resolve disagreements on their own.	Students can adapt and collaborate with all students with minimal teacher intervention.	Students demonstrate awareness of the needs of their classmates and care towards one another.
			Empathy, compassion
	Conflict resolution, self-regulation, locus of control	Collaboration, adaptability	Students interact meaningfully and joyfully together.
			Collaboration, respect, trust
Explicitly teaching and actively practising social-emotional skills	Students use a detailed vocabulary to describe their emotions and skills, and talk about their needs.	Students can identify strengths and weaknesses in their skillsets and set appropriate goals accordingly.	Students are eager for feedback from the teacher and their peers on their social-emotional skills.
	Self-awareness	Self-regulation	Open mindset, sense of purpose

Note: The signals are based on the contributions from the Schools+ Learning Circle and have been mapped to the 'transformative competencies' of the OECD Learning Compass in green.

Unlocking the potential to provide social-emotional support

Providing social-emotional support is shaped by the actions of the teacher in the classroom, but also shaped by the wider actions at the school- and system-levels. A deeper exploration of its complexity of can shed light on how school leaders can create more socio-emotionally supportive environments.

School ethos, shaped by leadership, crucially impacts the nurturing climate, which in turn affects classroom dynamics. Factors outside the teacher's control, such as students' backgrounds and the general school climate, tend to play a significant role in shaping socio-emotional well-being. It is worthwhile to note that schools in disadvantaged areas are more likely to face a compounded array of challenges that significantly amplify the complexities of educational and social-emotional support.

Opportunities in and outside the classroom can help teachers understand their students holistically, which is vital for being sensitive to the unique background that each of them brings. The time and space afforded by the wider school environment for understanding learners, especially when first forming relationships and the collaboration among teachers in sharing student insights, can be significant to this end.

Leadership decisions on class composition and teacher assignments can either support or complicate the development of positive relationships. The size and diversity of the class, continuity of teacher-student relationships, and the socio-emotional skills of some particular students are all factors to consider. For

instance, if certain students have historically struggled to work together in certain classes, this type of composition may demand considerable time and attention from teachers when it comes to relationship-building at the expense of other practices.

Schools also play an important role in creating the time and space for planning and professional collaboration. This seems particularly significant when it comes to explicitly teaching and practising of social-emotional skills. Shared planning time may allow teachers to develop a shared language for how they speak about these skills, as well as facilitating coordination of how the teaching and practising of skills occurs in a coherent way across different subjects and ages. Also, since explicitly teaching and actively practising social-emotional skills may not come naturally to all teachers and is a field of growing research, professional dialogue can be especially beneficial.

Box 4.2. Schools' strategies to strengthen social-emotional practices

Vilnius Barbora Radvilaite Progymnasium in Lithuania has developed a systematic approach to explicitly teaching and actively practising social-emotional skills across all academic years through 10-minute daily reflection sessions. Teachers are supported in the implementation of this practice by the school's Deputy Director, who acts as a coordinator for teachers' professional development. They offer ongoing guidance to teachers, conduct observations to provide personalised feedback to teachers, and organise professional learning workshops led by experts.

At **Marupe State Gymnasium** in Latvia, teachers participate in professional learning activities to learn how to build positive teacher-student relationships through personalised questions and their careful use of praise during lessons. Teachers regularly engage in peer-learning meetings with other colleagues to discuss on how they are building relationships with students. Additionally, school leaders conduct individual conversations with each teacher annually to plan targeted professional development for teachers around their ways of offering social-emotional support to students.

Westville School in South Africa, part of Keller Education, has developed a whole-school vision on building positive student-student relationships. Teachers participate in bi-annual expert-led workshops on supporting students to develop knowledge and sensitivity about different social-emotional skills for respectful inter-personal relationships. Peer-learning sessions among teachers are organised by school leaders to promote a shared vision and to share specific strategies around the different challenges of building student-student relationships.

In navigating the challenge of enabling high-quality social-emotional support in classrooms, school and system leaders may carefully consider some of the following questions:

- How do the values and ethics of the school manifest in the different, daily relations between students and teachers across the school, as well as with actors more widely? What is the culture that permeates the interactions and relationships of the school body?
- How does social-emotional support intersect with the size of classes and the diversity of groups? If school is helping students learn to live in society, is the school diverse enough to offer such opportunities? What forms of exposure or dialogue in the school help students understand the diverse range of groups and perspectives they will encounter?
- What activities at the start of the year can help to lay the foundational knowledge of social-emotional skills for then integrating skills and strategies in regular lessons?
- How to ensure that all teachers – regardless of their subject areas – dedicate time and space to students learning about and using social-emotional skills?

- How to ensure that teachers are aware of their own bias? What diversity is needed in the school to be representative of students and provide specific support or role models?
- What are the measures that can help gauge how the socio-emotional environment in the school is functioning? What indicators are more useful to ensure that early notice of students who might be struggling or isolated? How to coordinate among teachers on how to support individual students and smooth transitions?
- How can the most in-need students, and those displaying the most challenging behaviour, be best supported? What is the role of other services, the community and neighbouring schools to support in it?
- How to both set limits to over-engaged parents and cater to the hardest to reach?

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Annex 4.A. Summary of considerations and insights for the practices of social-emotional support

Annex Table 4.A.1. Summary of considerations and insights for the practices of social-emotional support

	Structure of the task, activity or content	Role of students	Role of teacher
Nurturing a supportive classroom climate	How to build a sense of safety and belonging? • Revisit expectations periodically. • Reiterate that mistakes are welcome. • Provide moments of joy that foster community and warmth. • Undertake a whole-class challenge to improve something in the school collectively.	Do students exercise agency in shaping the classroom climate? • Co-develop with students a real and concrete outline of the class's expectations. • Provide opportunities to hear students voices about how they feel. • Give students occasions to make decisions on how potentially stressful situations unfold.	Is praise and encouragement provided in a careful manner? • Be sincere and balanced, avoiding extremes when providing praise. • Focus praise on the processes, where students develop the skills.
Relationship building (teacher-student)	How to make time for individual students? • Consider open-ended activities at the start of the lesson. • Create opportunities for occasional and quality one-to-one talks.	Can students share their authentic selves? • Ask open-ended questions to encourage opinions and reflections. • Give students agency to develop a piece of work sharing who they are. • Communicate being approachable and available.	How to be fair and consistent with students? • Explain the why you have taken a decision. • Self-monitor interactions.
Relationship building (student – student)	How to design for positive interactions? • Invest in time for students to interact with each other. • Create opportunities for collective achievement and celebration. • Draw attention to relevant connections between students.	Do students know how to manage their relationships? • Acknowledge and troubleshoot conflictual situations as a class. • Ask students reflect around group dynamics that can arise.	What types of communication and behaviours can promote relationships? • Set clear expectations about the tone of interactions. • Model active listening strategies.
Explicitly teaching and actively practicing skills	How to introduce specific skills and strategies to students? • Build a clear and shared language for talking about social-emotional skills. • Celebrate examples of the skills in action in the classroom.	Do students have regular, integrated practice opportunities to use different skills? • Tie the use of skills and strategies to the subject matter. • Build a routine that encourages self-monitoring of social-emotional skills development.	Can skills or strategies be directly modelled by the teacher? • Highlight when the teacher is also using the same skills. • Participate in the skill-learning and provide reflections.

5 Fostering classroom interaction

This chapter focuses on facilitating high-quality interactions in the classroom through questions and responses and facilitating opportunities for students to collaborate and engage in whole-class discussions. The complexity for teachers lies in establishing clear routines, balancing teacher and student agency, and ensuring an equitable environment of interaction.

In Brief

- Classroom interaction focuses on the talk between the teacher and students and between students themselves in the classroom.
- Extensive research has developed over the last four decades that shows the benefits of rich classroom interaction between the teacher and students, and between students themselves.
- To foster classroom interactions, teachers can make use of the following practices:
  - questioning and responding
  - student collaboration
  - whole-class discussion.
- The teaching complexity across these practices is characterised by the challenge of encouraging all students to actively participate in an equitable way. It also sees teachers navigating how to establish the norms and routines that will facilitate high-quality contributions, including students becoming increasingly responsible for these.
- To assess the effectiveness of the implementation of the three practices, teachers need to gauge signals such as the ability of students to constructively disagree with a peer, or students taking the time to plan their responses to carefully align to a question.
- The broader school environment shapes how teachers navigate such complexity and effectively implement practices. For instance, the nature of routines and norms for student behaviour across the school may inform how the transitions and logistics of classroom interaction practices, while the provision of time to plan the details of particular questions or tasks may shape their quality.

Understanding classroom interaction

Classroom interaction is talk between the teacher and students and between students themselves. Classroom interaction considers the ways in which teachers engage students in whole-class discussion or dialogue, in particular by asking probing questions about the content in focus. It also considers situations where students collaborate, working together on tasks with a shared goal in pairs or small groups.

In both situations (teacher-student whole-class interaction, and student-student interaction), students are required to explain their thinking: to the teacher and the whole class, or to other students in a small group. They also need to listen to, engage with and build on the thinking and ideas of the teacher and of other students. Both situations can be parts of the same lesson or a unit of lessons.

The impact on student outcomes

Extensive research has developed over the last four decades that shows the benefits of rich classroom interaction between the teacher and students, and between students themselves, for student learning outcomes (Kim and Wilkinson, 2019[1]; Mercer, Wegerif and Major, 2019[2]; Murphy et al., 2009[3]; Nystrand, 2006[4]; Palinscar, 2019[5]).

Furthermore, studies have also found that the benefits of high-quality classroom interactions stretch beyond student cognitive outcomes, and that there also social and emotional benefits for students (Alexander, 2018[6]; Park, J. et al., 2017[7]; Resnick, Asterhan and Clarke, 2015[8]). Interactive discussions

stimulate students' interest, promoting their thinking and reasoning, and, at the same time, enhance their social relationships with others (both the teacher and other students), as well as their feelings about themselves as learners (Gillies, 2016[9]; Jay, T. et al., 2017[10]).

Classroom interaction can also indirectly benefit student learning due to the information that it furnishes to teachers. Students' talk is a key source for teachers to learn about their students. By encouraging students to share their thinking, teachers can come to understand how their students make sense of tasks and ideas, diagnose what misconceptions they have or challenges they have encountered, and what they might need to progress (Alexander, 2018[6]; Wiliam, 2017[11]).

Box 5.1.Notable debates and definitions

- One challenge is that different words are historically used to talk about 'classroom interaction' (e.g. classroom discourse, discussion, or dialogue) and with different definitions. Furthermore, what classroom interaction looks like can vary across contexts and cultures (Alexander, 2000[12]; Clarke, Xu and Wan, 2010[13]).
- Classroom interaction does not mean that extended student contributions and student-student collaboration prevail in every lesson, and the whole lesson.
- A key concern that is voiced by some teachers and policy-makers, and perhaps parents, too is that talk in class, especially between students, too quickly becomes social and detracts from opportunities for writing. This debate is sometimes referred to as the 'oracy-literacy' dichotomy (Alexander, 2020, p. 76[14]). Yet, talk and writing are complementary: talking can help express and explore tentative ideas, while writing provides an opportunity for more organised and rigorous thinking.
- Student talk does not necessarily make classes more noisy or teachers' talk less important; but these do increase the complexity of teachers' role in managing more interactive classrooms (Alexander, 2018[6]; Howe and Abedin, 2013, p. 17[15]). Classroom interaction can look different across cultures and contexts. Research has also documented cultural variation in how discussion and dialogue appear, as the way people communicate is shaped by cultural practices (Xu and Clarke, 2019[16]).

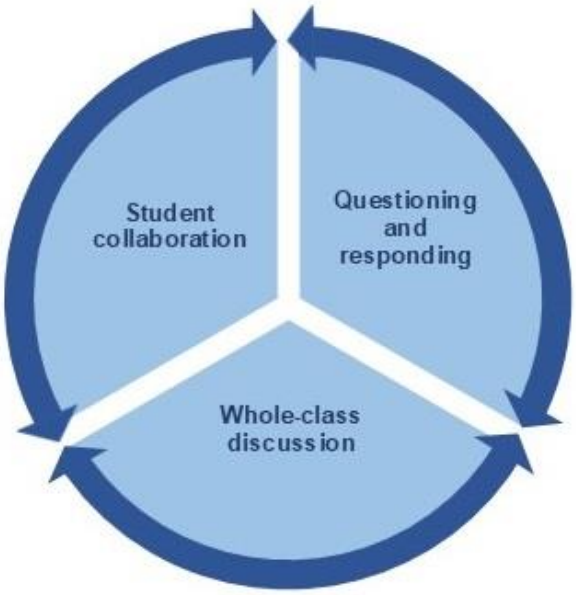
Teaching practices for fostering classroom interaction

Classrooms are interactive spaces from the very beginning of a lesson to its end. Furthermore, interaction can take many forms, and these can also change and evolve over a lesson. It is therefore inevitably challenging to break down and present classroom interaction in a coherent way. To foster classroom interaction, teachers can make use of the following practices:

- questioning and responding
- student collaboration
- whole-class discussion.

All of these practices are important and interconnected. Teachers often move fluidly between various forms of classroom interaction within a single lesson. Student collaboration and whole-class discussions can deepen student thinking and offer opportunities for students to practice articulating their understanding, while questioning and responding further stimulate student thinking and provide valuable insights into their progress. All these practices are important and there is no particular hierarchy among them.

Figure 5.1. The interrelations across classroom interaction practices



Each of these practices are outlined one-by-one below. Each section presents a definition for the practice and other associated terms on how it might also be referred to; key research findings on its impact on student outcomes; main implementation challenges identified by researchers and schools in designing the structure of the activity, task or content, role of students and role of teachers. Then, it looks into the complexity for teachers to foster classroom interaction and some of the enabling conditions that may be significant. The final section builds on schools' insights to provide an indication about the complexities of implementation and provides reflection questions for instructional and school leaders.

Questioning and responding

The questioning engages students in a range of levels of cognitive reasoning. These are varied and appropriate for students (e.g. reasoning that asks students to analyse, synthesise, justify, or conjecture) and done in a manner to ensure all students are cognitively engaged and challenged.

The questioning offers a window onto student thinking and their levels of understanding. This may include the teacher facilitating students posing these types of questions to their peers.

Associated Terms: *Quality of questions; High-leverage or higher-order questions; Probing or enquiring*

Key research findings

There is evidence that questioning that facilitates learning requires students to think for themselves and engage in a range of levels of cognitive reasoning that privileges, particularly higher-order reasoning – reasoning that asks students to analyse, synthesise, justify, or conjecture (Alexander, 2020[14]) (Henningsen and Stein, 1997[17]). Characteristics of such questioning are an appropriate mixture of varied discourse patterns, including IRE (initiate, respond, evaluate), recall questions, and students speaking

back-and-forth to one another or one after another without the teacher evaluating each student's response. In this last situation, supportive questioning places the teacher in a facilitating role rather than directing or controlling the discourse (OECD, 2020b[18]; Williams and Baxter, 1996[19]).

A recent study exploring the why and how of elaborated and extended dialogue found open questions – where an extended answer was required – were crucial (Hennessy et al., 2021[20]). Even more important than open questions was the follow-on contingent questions asking the students to give reasons for their responses, and/or explain how they worked out their responses (Rojas-Drummond et al., 2013[21]; Sedova and Navratilova, 2020[22]; Sedova et al., 2019[23]). For instance, Bishop (2021[24]) investigated teacher response patterns to student contributions with a convenient sample of 13 teachers and 250 students. Multilevel modelling showed a significant positive relationship between highly responsive teacher moves, such as revoicing or posing follow-up questions that explored student ideas in more detail, and student learning of the focus mathematics topic. It was also of note in the study that the level of cognitive work demanded by the teacher's question was related to the level of response given by students, meaning that when teachers asked low-level questions, they got low-level responses, while high-level questions where related to an increase in the instances of high-level responses albeit still with some variation.

What are some of the key considerations when implementing?

Structuring: How to initiate impactful questioning and responding?

Initiating questions launch student thinking and provide a platform for responses. Typically, this is achieved through either open or closed questions, which is informed by the immediate goal in the lesson. Open questions create possibilities for students to provide expanded answers, building their narrative skills as well as their vocabulary (van der Wilt, van der Veen and Michaels, 2022[25]). They may also heighten student agency by inviting them to bring in a wider array of thoughts and ideas. Closed questions ask for a clear and definitive answer, such as a yes or no, or a particular solution or definition. They typically serve to gauge student understanding around a specific focus or to activate thinking about specific knowledge (Howe and Abedin, 2013, p. 10[15]; Vrikki et al., 2018, p. 88[26]).

Insights from schools:

> ***Avoid evaluating the responses at first*** *but continue to pass the question on to other students by simply thanking students for their answer and then saying to someone else "what do you think?".*
>
> ***Elicit a range of responses quickly to build early engagement****, such as by using mass participation tools like mini-whiteboards or technological tools, or quick-fire questions around the room.*
>
> ***Give students the chance to disagree with a provocative statement on the subject*** *matter, such as by responding to a statement like 'the most importance factor in the topic is X', or an intentional 'spot the mistakes' exercise. Students enjoy the degree of argumentation.*

Students: How can high-quality participation from all students be promoted?

A large body of research has examined how questioning can be equitable in the classroom so that all students have the chance to offer high-quality responses. This has included investigating ways to ensure that questioning is accessible, such as by giving students adequate time to process a question and think through their response (Ingram, 2016[27]) or reformulating questions to scaffold students' participation when needed (Harumi, 2023[28]). A further area of notable research has been on how questioning may be subject to biases and how this can be monitored to manage the distribution of high-quality questions to facilitate more equitable participation from students (Consuegra, Engels and Willegems, 2016[29]; Skelton and Read, 2006[30]).

Insights from schools:

> ***Writing the question as well as speaking it can make it more accessible to second-language learners,*** *and give them the time to read it several times.*
>
> ***Model to students out loud how to identify the key words in a question*** *and how to deduce what those words must mean for their response.*
>
> ***Build a routine of thinking and writing time before responses and be explicit about why it matters****. Let students know how long you want them to think – depending on the question – and why it matters for the quality of responses that there is no calling out or raising hands straight away.*
>
> ***Try to forewarn students who are quieter that you would like them to contribute*** *– when circulating the room and seeing their work, a quick "That's a really interesting answer, do you mind sharing that with the class later?" can let them mentally prepare.*
>
> ***Let students test out ideas with a peer first****, so that they can refine their initial thinking and then when they are sharing an idea with the whole class it is the pair rather than the individual contributing.*

Teacher: Are follow-up questions further stretching student thinking?

It is important that teachers master the process of asking 'how' and 'why' questions that can probe and push student thinking (Alexander, 2020[14]). These play a role in promoting more student elaboration of their ideas and more student participation (Hennessy et al., 2021[20]; Lefstein, Snell and Israeli, 2015[31]). In particular, questions that require students to analyse, synthesise, justify and conjecture demand higher levels of cognitive functioning (OECD, 2020a[32]).

Insights from schools:

> ***Explain to students why you will use questions that probe and push their thinking****, so they understand how it is a tool for helping them to think harder, as well as a way of helping their peers hear more complex thinking.*
>
> ***Develop a clear prompt and routine that let's students know they need to share more of their reasoning****, the same simple prompt of "Can you go deeper into why you are saying that?" or "Can you tell us more?" can be a quick tool for highlighting to students that more detail is needed.*
>
> ***Play 'the devil's advocate' and challenge students to convince you with more justifications and rationale****; a prepared counter argument, such as an alternative perspective or interpretation, can help encourage students to further engage.*
>
> ***Be mindful of follow-up questions that may be too open and broad*****,** such *as "Can you talk about this with a partner?", as these may prompt students to actually go in completely the wrong direction or overwhelm students with too many possibilities when a clearer focus may lead to clearer responses.*

Student collaboration

Students have opportunities to work together either in pairs, or in small groups on a shared learning goal. This revolves around carefully structured tasks that are conducive to meaningful collaboration, which may mean students are working on separate tasks contributing to a common overall outcome, or together on a shared task.

Whatever the arrangement, students take turns to participate, ask each other questions and listen to and interrogate each other's ideas and responses. Students give explanations of their thinking, exchange ideas, explore issues, formulate new ideas and derive solutions. Furthermore, during this, all students in a small group, or both students working in a pair, have turns to participate.

Associated Terms: *Collaborative learning approaches; Pair work and small group work; Peer tutoring*

Key research findings

Webb et al. (2021[33]) summarise evidence from comparative and correlational studies, as well as from more detailed case studies, that has accumulated over many years. They note that results in student learning, whether through comparison or by linkage with student test scores, showed improved learner attainment. In particular, they highlight how the level of detail in students' talk makes a difference to learning outcomes; when the tasks the pairs or groups were working on required learners to explain and clarify their thinking, give supporting reasons, and discuss each other's ideas in a detailed, rigorous way, there was higher student achievement. These results are echoed in other studies, with several meta-analyses showing that students working in small groups indeed achieve higher learning outcomes than students working on a task individually, such as in terms of increased performance on standardised or teacher-made tests (Howe, 2010[34]; Resnick, Asterhan and Clarke, 2015[8]; Kyndt et al., 2013[35]; Rohrbeck, C. et al., 2003[36]; Roseth, Johnson and Johnson, 2008[37]; Chen et al., 2018[38]). Some studies have also demonstrated positive effects of collaboration on not only cognitive outcomes but also meta-cognitive, affective-motivational and social aspects of learning (Johnson and Johnson, 2008[39]).

Of note though is the considerable research around the connection between positive outcomes and the teacher's role too. van Leeuwen & Janssen (2019[40]) conducted a systematic review of teacher guidance during collaborative learning in primary and secondary education. They argue that the positive results from collaborative learning hinge upon the instructional decisions of teachers, suggesting that impactful collaboration is not spontaneous and automatic, a finding echoed across other studies too (Cohen, 1994[41]; van de Pol, Volman and Beishuizen, 2010[42]; Kaendler et al., 2014[43]).

What are some of the key considerations when implementing?

Structuring: How to design impactful collaboration tasks?

A consistent point across research is that student collaboration needs to be carefully organised around a task or activity that can support effective collaboration (Gillies, 2016[9]). This includes the task being conducive to students explaining and justifying their thinking to each other, and students discussing each other's ideas in a meaningful way. Accordingly, teachers may need to attend to students' prior knowledge levels and consider if they are well-prepared for this type of explanatory, meaningful talk.

It also means that teachers need to consider structural aspects. Research suggests that pairs can be productive, and that three to five students is the ideal in groups (Alexander, 2020[14]). This also relates to the considering the group's dynamics, informed by the teacher using their knowledge of students of how certain compositions of groups may, or may not, work productively.

Insights from schools:

> ***Spend some time first preparing students for the collaborative task*** *by surfacing the key pieces of previous learning that students should be mindful of through a whole-class, small group, or online brainstorm.*
>
> ***Provide a clear, quality example of what the final output should be like****, such as a piece of work from a previous year or class, to communicate high expectations and so students know exactly what to aim for.*
>
> ***Break the task down into stages*** *to reduce the risk of them losing focus or being overwhelmed. Stages can be written out on a prompt, or also communicated through a model example.*
>
> ***Give students advance warning of when collaborative tasks are coming up*** *so they can prepare and know what type of knowledge they will need to have ready.*

Students: How to give students enough agency?

Collaboration is not only a way for students to engage in productive talk that enhances their learning (Alexander, 2018[6]), but also an opportunity for students to develop a broader range of skills and dispositions, that are important for students' social-emotional development (Johnson and Johnson, 2008[39]). In this respect, the process of collaborating is valuable in itself, and teachers can play a role in heightening students' agency in the collaboration to help them foster skills like managing interactions, negotiating ideas, and working towards a common goal.

Insights from schools:

> ***Ask students to define what types of behaviours or skills they expect*** *from each other before collaborating, to increase their buy-in and engagement with positive collaborative behaviours.*
>
> ***Provide students with a clear outline of the success criteria*** *that they can monitor their work against in an ongoing way. For instance, what are the different questions or steps they need to fulfil and evidence?*
>
> ***Challenge students to give peer feedback to other groups****, at periodic points on specific criteria, so students have not just ownership of their own collaboration but also in shaping high-quality learning across the whole classroom.*
>
> ***Give students space to reflect on the collaboration experience****, so they have a record of this and can take ownership of improving these elements the next time.*

Teacher: How to monitor and guide students during collaboration?

A systematic review by van Leeuwen & Janssen (2019[40]) found that several aspects of teacher guidance are positively associated with student collaboration, such as giving feedback on students' strategies or helping students plan their task, progress and resolve conflicts. To this end, during collaboration, teachers can monitor which problems students encounter and thoughtfully intervene when necessary (van de Pol, Volman and Beishuizen, 2010[42]).

Insights from schools:

> ***Establish simple and clear routines for getting into collaboration*** *that guide students to transition into collaborating in a focused, efficient way that avoids distractions.*
>
> ***To ensure everyone contributes early on****, try instigating a rule that everyone speaks at the beginning one-by-one, even if sharing one simple piece of prior knowledge or an initial idea.*
>
> ***Pay attention to power dynamics*** *and be ready to adjust groups or to take time to revisit the collaboration norms as a whole class.*
>
> ***Consider assigning roles to students****, particularly if they are struggling to start or certain students are excluded, such as each person writing one paragraph of the essay or handling one specific task. Be mindful though that each role should have cognitive demands – time-keeping is not a role that will stretch students' learning.*
>
> ***Pose open-ended questions*** *that prompt students to think about their collaboration in a different way, be that looking back to specific examples from previous work when struggling, or considering an alternative approach to push them further on.*

Whole-class discussion

The teaching provides for whole-class discussion of key ideas, procedures, and perspectives in different parts of a lesson. The teaching makes it possible for students to express their thinking to others in the class, and share how they are reasoning about an idea or problem. Students have opportunities to engage with the ideas of others and build on these.

These are orchestrated in a way that all students have opportunities to contribute their ideas to the classroom discussion.

Associated Terms: *Class dialogue; Discussion opportunities; Classroom discourse; Student oracy*

Key research findings

Evidence has accumulated over four decades across a range of countries and in different subjects that whole-class classroom discussions can lead to positive learning outcomes for students, specifically greater retention and transfer of what students have learned (Resnick, Asterhan and Clarke, 2015[8]). However, researchers have also consistently emphasised that rich and deep discussions do not happen automatically (Alexander, 2018[6]; Nystrand et al., 2003[44]) but require time and careful, constant thinking from teachers.

Significant evidence comes from a randomised control trial investigating classroom interaction between the teacher and students, and students themselves (Jay, T. et al., 2017[10]). The study worked with some 78 schools in three different English cities and focused on students aged 9-10 years old. The study found that students in the intervention group were on average up to two months ahead of their control group peers in English, maths and science. The qualitative data of a simultaneous video study (included as part of the evaluation) established that in the intervention classrooms, there was more extended and elaborated dialogue between the teacher and students, such as students disagreeing with each other, and the teacher encouraging students to develop their ideas and respond to others' ideas. Accompanying teacher interviews found that while some teachers found the programme challenging, all the teachers were in favour of developing more interaction in their classrooms and strategies for doing this (see also Alexander, 2018[6]).

The findings echo a mixed methods study in Finland examining 46 teachers and more than 600 12-year-old students. The researchers found that the quality of educational dialogue correlated positively with students' grades in language arts and physics/chemistry (Muhonen et al., 2018[45]). Again, observational methods suggest that higher quality educational dialogues were present in physics/chemistry lessons which also demonstrated more versatile and richer scaffolding strategies from teachers.

What are some of the key considerations when implementing?

Structuring: How to ensure equitable opportunities to participate?

A key consideration in whole-class discussion has been its inclusivity and ensuring that all students can participate (Vrikki et al., 2018[26]; Blatchford et al., 2010[46]). This equity issue is not merely a question of the quantity of talk; rather, high-quality talk needs to be made available to all students in a class. This demands consideration from teachers both in advance and in an ongoing way during discussion.

Insights from schools:

> ***Activate prior knowledge so that students are better prepared for meaningful participation****, such as facilitating a discussion once a good amount of prior knowledge has already been established, or by first conducting a recall activity with students.*
>
> ***Monitor who is participating and create space for different students to participate****, by drawing on knowledge of individual students and inviting them to share at strategic points in the conversation.*
>
> ***Make use of multiple forms of engagement****, such as technological tools where students can actively participate without having to speak out loud. Live documents or brainstorming tools can mean multiple contributions simultaneously or allow quieter students and second-language speakers to feel more comfortable.*

Students: Are students engaging with each other's ideas to drive the discussion forward themselves?

A notable feature of productive discussions is the sharing of ideas in a reciprocal, meaningful manner. Students should engage and build on each other's ideas in a cumulative way (Vrikki et al., 2018[26]; Alexander, 2008[47]). This type of discussion does not just happen automatically but is built through student-student interactions, and teachers can play a role in enabling this.

Insights from schools:

> ***Ensure students are aware of what makes a healthy interaction****, such as mutual respect, actively listening, and constructive questioning, so that they can actively self-monitor themselves and their peers.*
>
> ***Provide students with prompts to use to tie themselves to previous contributions****, such as sentence starters for constructively critiquing ideas, or for building on someone's contribution.*
>
> ***Focus discussions around a topic that students are not only knowledgeable on but also passionate about****. It may be that students can even choose the topic, or that if something really grabs student curiosity in the classroom then this can be pursued at a whole-class level.*
>
> ***Let students take on the role of moderator or a specific 'expert' as part of a discussion panel****. These roles can be rotated among students. Many enjoy the responsibility, but it also helps them understand more how they can best contribute later when they are participating again and no longer in a role.*

Teacher: How to encourage higher quality, more detailed contributions?

Rich classroom discussion is heavily dependent on the quality of the contributions from students. Teachers play an important role in encouraging these, which in turn can mean a thriving discussion and, thus, crucially learning too (Alexander, 2018[6]; Michaels and O'Connor, 2012[48]).

Insights from schools:

> ***Show students the difference between high-quality contributions and more superficial ones*** *prior to a discussion, so that they have a clear understanding of what to share and why it matters – both for them and their peers.*
>
> ***Give students advance warning****, such as a homework activity where they must prepare a well-reasoned contribution on the topic in advance of the discussion, so students have the time to think hard and research their arguments.*
>
> ***Challenge students to revisit their ideas during the discussion*** *by letting them know you will be coming back to them and you'd like them to try rephrase their thinking a second time in a clearer way, connect to prior learning, or include more advanced, specific subject vocabulary.*
>
> ***Highlight particularly high-quality contributions*** *when they arise, identifying the specific features that made it impactful and encouraging others to emulate these.*

Observing the effects on students

Interactions are constant and multiple in a classroom. Teaching can be very fluid, seeing the forms of interaction change as needs evolve in a classroom. Monitoring of how classroom interaction is unfolding and if it needs adapting is a constant process for teachers, who use their professional judgement to process the signals that they receive from students in real-time. This can be overwhelming at times. Furthermore, teachers need to balance and monitor individual students' progress with fostering effective group interactions.

Schools' insights on the in-situ classroom signals for classroom interaction (Table 5.1) demonstrate the demands of monitoring interactions to ensure they are impactful for students. The signals can be thought of as the short-term, in-class manifestation of the long-term knowledge, skills, values and attitudes that teachers seek to encourage. These include:

- **Knowledge:** Teachers are attuned to noticing progression in students' thinking. This is seemingly primarily characterised by identifying increasingly detailed contributions from students – whatever level that may manifest, be it at the whole-class or student-student level.
- **Skills:** Teachers monitor the clarity of communication, with particular attention to how reasoning is articulated, including the evaluation of arguments and ideas that have already been voiced.
- **Values and Attitudes:** Teachers pay close attention to how mutual respect and active, enthusiastic engagement are demonstrated during collaborative or whole-class exchanges. Students' openness to different perspectives and their ability to appropriately handle this divergence is attended to as well.

Table 5.1. Signals from students on classroom interaction

	Knowledge	Skills	Values and attitudes
Questioning and responding	Students' thinking progresses in detail and quality as the cognitive load of questions increase	Students take the time to think and strategically plan their responses to align to the question	Students enthusiastically seek opportunities to participate and share their answers with their peers
	Tolerance for complexity and ambiguity, resilience	Self-regulation, adaptability	Curiosity, open mindset
Student collaboration	Students with different levels of prior learning are able to build knowledge together that responds to the task's focus	Students can distribute tasks to each other to move forward towards a shared goal	Students actively engage with one another and ask questions of each other to encourage participation
		Collaboration, problem-solving skills, trust	
	Collaboration, responsibility [towards others], adaptability	Students collectively self-monitor their work to track their progress	Responsibility [towards others], collaboration, self-awareness
		Self-regulation, conflict resolution	
Whole-class discussion	Students use relevant examples from their own perspectives to build well-reasoned arguments	Students can identify strengths and weaknesses in arguments	Students respect alternative arguments and demonstrate an openness to considering different perspectives
		Critical thinking, reflective thinking	Empathy, respect, open mindset
	Critical thinking, reflective thinking	Students can constructively disagree with a peer's argument	
		Empathy, respect, conflict resolution	

Note: The signals are based on the contributions from the Schools+ Learning Circle and have been mapped to the 'transformative competencies' of the OECD Learning Compass in green.

Unlocking the potential of teachers to foster classroom interaction

Classroom interaction is shaped by the actions of the teacher in the classroom, but it is also informed by the wider actions at the school- and system-levels. A deeper exploration of its complexity can also shed light on ways in which school leaders can support teachers in fostering high-quality interactions in classrooms.

Norms and routines established at the school level, such as behavioural expectations and shared values, help standardise interactions across classrooms. This consistency aids students in self-monitoring and adapting to structured interactions and transitions, which is crucial for activities like questioning and responding or whole-class discussions. These routines also help mitigate power dynamics and encourage diverse student participation, emphasising the importance of engagement and listening in discussions. For example, communicating what is expected in a contribution – or, when students are collaborating together – can be significant. Reinforcement of these expectations across classrooms may help foster more productive interactions more consistently.

Teacher preparation and professional collaboration also play critical roles in shaping classroom interactions, even if these are always somewhat unpredictable and thus naturally contingent. When it comes to questioning and responding, for example, a key challenge revolves around gauging when deeper questions are more relevant and how these are to be formulated to spur that appropriate level of cognitive load. Teachers' ability to carefully prepare questions and their accompanying potential scaffolds or extensions can facilitate teachers' in-class attentiveness to student learning signals.

Enabling student collaboration or whole-class discussions may be more demanding for teachers with larger classes – not just to give everyone a fair chance to participate but also to align to their prior knowledge- and limited physical spaces or resources. For example, structuring collaboration may be challenging in more limited physical spaces or resources needed for the collaboration (e.g. samples, equipment). In considering the assignment of teachers to students, leaders may also consider the relationships that already exist and how these have a bearing on the nature of interactions.

Box 5.2. Schools' strategies to strengthen classroom interaction practices

Allan's Primary School, in Scotland (UK), has designed a school-wide student collaboration initiative with the goal of closing attainment gaps. Teachers carefully choose the composition of groups and the nature of the collaborative task to focus on promoting knowledge exchange among students. The school has created a self-sustaining implementation centred on an appointed team of lead teachers, who organise mentoring sessions for colleagues, oversee the onboarding of new teachers to this initiative, and conduct progress reviews across the school.

At **Saint Matthew School** in Chile, part of Red de Escuelas Líderes (Fundación Chile), teachers make use of whole-class discussion coupled with student role-play in English lessons to develop and assess students' reading comprehension. Each academic trimester, school leaders organise three seminars for teachers to collaborate across years to create assessment rubrics to evaluate students' oral performance in alignment with the core curricula goals. These sessions have served to build consistency in evaluation standards and grading criteria at the school level.

IC Govone in Italy has partnered with the Department of Mathematics at the University of Turin to develop teachers' ability to craft rich mathematical questions. Teachers participate in six annual expert-led sessions where they focus on how to implement specific questioning strategies that can support engagement across a whole lesson and align to students' evolving mastery of key concepts.

In navigating the challenge of enabling high-quality classroom interaction, school and system leaders may carefully consider some of the following questions:

- How is a school culture cultivated where the potential temporary noise and disruption of interactive classrooms are understood as part of the learning process rather than as a negative behaviour?

- What policies and routines can schools implement to foster respect, appreciation of diversity, and rich contributions in the classroom?
- How does the size and diversity of the class shape the opportunities for student collaboration and whole-class discussion? How does it intersect with opportunities to pair teachers or make a second teacher available?
- Does a teacher for all subjects or across several years facilitate building the necessary routines for effective classroom dynamics? What is the role of whole-school approaches to shaping classroom interaction patterns across classrooms?
- How can school leaders ensure that teachers have enough planning time and flexibility in the curriculum to incorporate meaningful interactive activities?

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Annex 5.A. Summary of considerations and insights for the practices of classroom interaction

Annex Table 5.A.1. Summary of considerations and insights for the practices of classroom interaction

	Structure of the task, activity or content	Role of students	Role of teacher
Questioning and responding	How to initiate impactful questioning and responding? • Encourage students to evaluate or add answers. • Build early engagement through mass participation strategies or tools. • Use a provocative statement that students can disagree with.	How can high-quality participation from all students be promoted? • Present questions in written and spoken format. • Model how to identify a question's key words. • Build a routine of time to think before taking answers. • Prepare quieter students to participate. • Allow students to test ideas with peers.	Are follow-up questions further stretching student thinking? • Explain the reasons behind probing questions. • Develop a routine that encourages students to share their reasoning. • Challenge students with their justifications. • Be mindful of the breadth of certain follow-up questions.
Student collaboration	How to design impactful collaboration tasks? • Allocate time to surfacing prior learning. • Provide a clear example of the desired outcome. • Divide a task into different stages. • Signal upcoming collaborative tasks to students in advance.	How to give students enough agency? • Engage students in defining expectations for effective collaboration. • Outline to students the relevant success criteria. • Engage groups in peer feedback. • Give students the time to reflect on the collaboration experience.	How to monitor and guide students during collaboration? • Build routines for transitioning to collaboration. • Develop approaches that allow all students the chance to actively participate. • Monitor group dynamics. • Assign specific, engaging roles to students. • Pose open-ended questions that encourage students to try different approaches.
Whole-class discussion	How to ensure equitable opportunities to participate? • Activate prior knowledge for meaningful participation. • Monitor participation and support students to contribute. • Tap into digital tools for multiple forms of engagement.	Are students engaging with each other's ideas to drive the discussion forward themselves? • Ensure students understand what makes healthy interactions. • Use prompts to help students build on each other's contributions. • Consider students' passions and interests. • Let students serve as moderators or 'experts' in discussion panels.	How to encourage higher quality, more detailed contributions? • Make explicit the difference between high-quality and superficial contributions. • Provide students with activities to prepare arguments in advance. • Encourage students to critically revisit their ideas during the discussion. • Celebrate high-quality contributions and their specific features.

6 Using formative assessment and feedback

This chapter focuses on the ongoing process of teachers evaluating and guiding students' progress by setting learning goals, diagnosing student learning, providing feedback, and adapting to student thinking. Teachers must be attentive to the complex demands of choosing the best timing for different practices and attending to individual needs in large and diverse classrooms, all the while ensuring that students have agency to also steer their learning.

In Brief

- Formative assessment and feedback is focused on the processes of understanding student progress in relation to desired outcomes and the accompanying responses to this information that help move students further towards these outcomes.
- There is strong consensus that processes of determining levels of student understand and using this information to then provide feedback to students and inform instruction can have a high impact on learning outcomes.
- To facilitate formative assessment and feedback, teachers can make use of the following practices:
  - learning goals
  - diagnosing student learning
  - feedback
  - adapting to student thinking.
- The complexity of these practices is bound up in how teachers navigate catering to the individualised needs and learning of students. This complexity is added to through the ongoing, ever-evolving nature of these practices that demand sensitivity and reflectiveness from teacher, as well as their consideration of how students can be empowered with the valuable information formative assessment yields.
- To know if formative assessment and feedback is effective, teachers need to detect different signals such as whether students understand the cause of previous mistakes and can act upon feedback in a dedicated, meaningful way.
- The broader school environment shapes how teachers navigate such complexity and effectively implement practices. For instance, a school's approach to data collection and monitoring may help teachers in how they target their formative assessment and feedback, while the provision of digital tools or resources may shape how teachers handle the logistical challenges of catering to multiple student needs.

Understanding formative assessment and feedback

Formative assessment and feedback is about the process of setting the learning goals as well as understanding and further supporting students' progress towards them. It is an ongoing, fluid process; teachers elicit and consider student thinking, respond to this with appropriate feedback and pedagogical moves, and repeat the process in a regular, spiralling manner as student learning steadily advances. These are guided by the learning goals that teachers communicate to students, which demonstrate what students are working towards and inform the types of formative assessment activities teachers use to understand how students are progressing.

The impact on student outcomes

There is reasonable consensus that processes of determining levels of student understand and using this information to then provide feedback to students and inform instruction can have a high impact on learning

outcomes (Rakoczy et al., 2019[1]; Elliott, V. et al., 2020[2]; Kyriakides and Creemers, 2008[3]; Muijs and Reynolds, 2010[4]; Scheerens, 2015[5]; Wiliam, 2011[6]).

In particular, there is a strong body of evidence that has been established across subjects, age groups and student groups documenting the important role that providing feedback to student thinking can play in pushing student learning forward (Wiliam et al., 2004[7]; Newman et al., 2021[8]; Webb et al., 2021[9]). It can be a very high impact approach if implemented thoughtfully and effectively, as evidenced by large systematic reviews (Newman et al., 2021[8]) and meta-analyses (Wisniewski, Zierer and Hattie, 2020[10]).

This feedback hinges upon correctly understanding levels of student understanding in order to ensure alignment between student understanding and feedback (Black and Wiliam, 2009[11]; Chiu, 2004[12]; Wiliam, 2017[13]). Indeed, the picture is complex; high-quality feedback can be hard to implement (Gorard and Siddiqui, 2016[14]) and some studies have shown that feedback may have negative effects on students (Kluger and DeNisi, 1996[15]; Wiliam, 2011[6]). For instance, comparative feedback between students, rather than using a student's previous performance as an individual reference norm, may be less effective for student learning (Wiliam, 2011[6]). Similarly, a reasonably consistent finding is that feedback that does not contain information, but instead contains features like rewards or punishments or a focus on students' self-concept and personal traits, has a low or even negative effect on motivation (Wisniewski, Zierer and Hattie, 2020[10]).

Box 6.1. Notable debates and definitions

- The term assessment is used to refer to judgements on individual student progress and achievement of learning goals. It covers classroom-based assessments as well as large-scale, external assessments and examinations (OECD, 2013[16]). The focus in this chapter is that of classroom-based assessment.
- A common organisation of assessment is into two forms: summative and formative assessment. Summative assessment, or assessment *of* learning as it is sometimes also framed, aims to summarise learning that has taken place, in order to record, mark or certify achievements. Meanwhile formative assessment, or assessment *for* learning as it is also sometimes framed, aims to identify aspects of learning as it is developing in order to deepen and shape subsequent learning (OECD, 2013[16]). Formative assessment is the primary focus of this chapter as it has at its heart the goal of using information to support students to do better at what has been assessed.
- As mentioned, assessment for learning is also a commonly used term that has many similar features to formative assessment. Assessment for learning is assessment that is designed to improve learning (rather than measure it), but for it to be formative the results need to be used to improve teaching. The extent that something is formative can be judged, as outlined by Black and Wiliam (2009[11]), in terms of how "evidence about student achievement is elicited, interpreted, and used" (p.9), such that decisions on instruction are better informed.

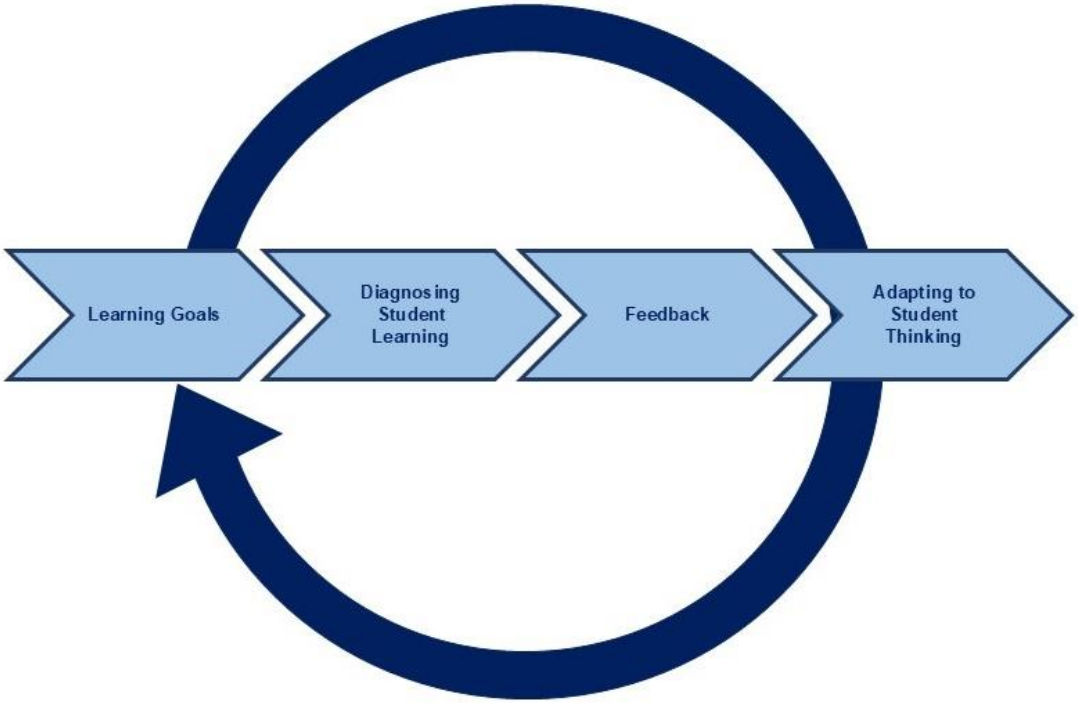
Teaching practices for using formative assessment and feedback

Learning is an ongoing process. Teachers need access to information on how this learning is progressing, so that they can recalibrate their teaching and provide appropriate support. However, this means there is then a need to again understand how learning is progressing – has it improved, or is a different approach needed? Teachers engage in formative assessment and feedback by:

- learning goals
- diagnosing student learning
- feedback
- adapting to student thinking.

All of these practices are important and inter-connected, and teachers might draw upon them simultaneously. Even if there is no strict sequence or endpoint, formative assessment and feedback are often seen as a continuous process that begins with setting learning goals to provide direction. This is followed by diagnosing student learning, which then informs both the direct feedback given to students and how teachers adapt to students' thinking.

Figure 6.1. The continuous process of formative assessment and feedback



Each of these practices are outlined one-by-one below. Each section presents a definition for the practice and other associated terms on how it might also be referred to; key research findings on its impact on student outcomes; main implementation challenges identified by researchers and schools in designing the structure of the activity, task or content, role of students and role of teachers. Then, it looks into the complexity for teachers in monitoring them in the classroom. The final section builds on schools' insights to provide an indication about the complexities of implementation and provides reflection questions for instructional and school leaders.

Learning goals

Learning goals are what students are aiming to achieve and master in a lesson or sequence of lessons. They are clearly communicated to students verbally, in written form, or both. They may be established with or for students so that they clearly understand what they should be able to do and demonstrate.

Learning goals will convey the success criteria for mastering certain knowledge or skills, and may also include certain values or attitudes, and associated behaviours, that students should be aiming to demonstrate. Students will also have an active role in also monitoring their progress against the goals.

Associated Terms: *Expectations; Aims and objectives; Learning intentions; Success criteria; Structuring and sequencing*

Key research findings

Research into teacher effectiveness has consistently identified the use of learning goals as a contributing factor to a well-structured learning environment, and accordingly associated it with student learning (Kyriakides and Creemers, 2008[3]; Muijs et al., 2014[17]). A large body of evidence on student motivation and student psychology has also contributed to understanding around learning goals. Research has suggested that students can be motivated to reach goals that are specific and challenging yet attainable (Schunk, 2003[18]; Bandura, 1991[19]; Locke and Latham, 2002[20]).

In translating this research into day-to-day teaching, researchers have argued that it is important that learning goals are clear, shared and understood, by both teachers and students (Wiliam, 2011[6]), in order to support students' ability to self-regulate their learning. This connects to a substantial body of evidence relating to metacognition and self-regulation. This body of evidence argues that students can benefit from having opportunities to learn and practise how to become self-regulated learners (Education Endowment Foundation, 2020[21]). These are learners that monitor their behaviour and learning in terms of their goals and the effectiveness of their progress towards these goals.

What are some of the key considerations when implementing?

Structuring: How can learning goals be communicated clearly and accessibly?

One contributing factor to low achievement may be students not fully understanding what teachers expect of them (Black and Wiliam, 1998[22]). Goals need to be clear and comprehensible to students. This means it is important to ensure that students engage with understanding what the target knowledge and skills are (Wiliam, 2011[6]). This includes engaging students with the key ideas behind this goal and what successful completion may actually look like.

Insights from schools:

> ***Show the expected outcome*** *with examples of 'what a good final output looks like', highlighting the features that made it a success. This could be contrasted with a 'partial' success to show the difference.*
>
> ***Draw attention to short-term and long-term goals****, so that the learning goal seems feasible and students understand the key steps of progression ahead of them. For instance, portraying this as a learning 'map' or 'journey' can be meaningful and clear, where students can track their progress along the way.*
>
> ***Balance student-friendly language and technical vocabulary*****,** so *that students can understand what is tangibly expected of them while using disciplinary language.*

Students: Do students understand the relevancy of goals?

Teachers can share learning goals in a way that support students' thinking about what they will learn and where it fits with other topics they have learned, as well as how it relates to their personal experience (Rakoczy, K. et al., 2007[23]). This can help students to see how their learning is progressing, which is significant considering low expectations of students can negatively impact self-confidence and student motivation (Prediger and Neugebauer, 2020[24]; Jussim and Harber, 2005[25]; Schneider et al., 2022[26]). Wider connections to the real-world or students' lives may help highlight the relevance of what they are doing, giving the goal new meaning.

Insights from schools:

> ***Explain the logic of the new learning goal*** *in how it connects to prior learning and how it is moving students forward by now adding something new to their skillset or knowledge.*
>
> ***Address the bigger picture 'why' behind goals,*** *such as examples of how the goal's work is applicable to certain challenges, questions or careers - of course students may always say '"That doesn't interest me!', so ideally there needs to be a focus on transversal skills and a range of applications.*
>
> ***Give scope to shape the learning goal****: if the goal is being able to say analyse a text for a particular feature, or factors behind a historical event, can the students choose the content focus on?*
>
> ***Challenge students to create an 'individual goal' the sits alongside the collective one of the class****, which could be something they struggled with before, a skill or piece of content, and can now try to focus on too.*

Teacher: How to revisit learning goals during the learning process to support self-monitoring?

It is important to return to the learning goals at different points in the lesson to support students, as well as the teacher too, to monitor students' progress towards learning goals. Regular opportunities to monitor their thinking can be important for promoting students as self-regulated learners (Education Endowment Foundation, 2021b[27]), with evidence from a large meta-analysis suggesting that students who perform in self-grading performed better on subsequent tests than those who did not (Sanchez et al., 2017[28]).

Insights from schools:

> ***Bring the long-term learning goal back into focus*** *at the start of a lesson with a student summary of the previous lesson. This can highlight where the class has got to on the overall progress to prepare for what comes next in the lesson.*
>
> ***Encourage a clear, structured way*** *of tracking how goals are being mastered that students can complete in an ongoing way, such as a portfolio or logbook of specific examples (e.g., questions, quotes, pieces of work) for different parts of a goal that students can then easily refer back to.*
>
> ***Re-doing a piece of work*** *can be a means of encouraging them to see their progress towards a goal.*

Diagnosing student learning

Teachers use formative assessment tasks or strategies to elicit and diagnose what students are thinking and understand their ongoing progress towards particular learning goals. These tasks or strategies are designed to capture students' reasoning to allow the teacher to better diagnose different levels of students' understanding. The teacher elicits a range of students' thinking to be best prepared to support all students.

Associated Terms: *Monitoring student learning; Interpreting student thinking; Probing student think; Making thinking visible*

Key research findings

Diagnosing student learning is a foundation of providing adequate feedback that supports students' learning (Wiliam, 2011[6]). Research has consistently highlighted (see Feedback below) that it is particularly important that feedback is relevant to students and closing the gap between where they are at and where they need to be. To provide this type of feedback it is vital that teachers know in a clear and accurate manner where students currently are in their learning (Black and Wiliam, 1998[22]; Elliott, V. et al., 2020[2]).

While few empirical studies have investigated eliciting student thinking as a standalone feature, it is a logical theoretical requirement for a number of well-evidenced practices, both in this chapter and in others. Where it is has been empirically investigated directly, results have been promising. In a classroom study,

Chiu (2004[12]) found that evaluating levels of student understanding was the key factor in determining how effective was the support later offered to students. Elsewhere, a lot of research has focused on how questioning can be used to elicit and diagnose student learning (Wiliam, 2017[13]). In particular, research has distinguished between the depth of understanding that certain questions may uncover, the timing of these questions, and how teachers can ensure they have a picture of student understanding across a range of students (University of Queensland, 2016[29]; Wiliam, 2011[6]).

What are some of the key considerations when implementing?

Structuring: When is the right time to elicit student thinking in a systematic way?

Trying to understand student thinking should be thought of as an ongoing dialogue, but teachers still need to think about the specific moments where they want to go beyond the constant small-scale, informal opportunities in the classroom (Ruiz-Primo, 2011[30]) to more systematically understand how students are progressing (Wiliam, 2017[13]). Teachers can strategically plan in advance where formative assessment of what students are learning could be most valuable, while remaining flexible in lessons to adjust these timings based on their perceptions of student progress.

Insights from schools:

> ***Following certain explanations of new content**, it can be useful to gauge how much of the explanation has been processed by a class – can students correctly identify and explain what the key steps were before they try it themselves?*
>
> ***When there is a common misconception that typically surrounds a certain part of the topic**, explicitly checking if students can differentiate between examples of work with and without a misconception can make it clear who has mastered this or not, and provide a platform for discussion.*
>
> ***Before progression to more complexity or a new idea**, it is helpful verifying that the foundations of what we have just been working on are solid.*

Students: How to diagnose the thinking of as many students as possible?

Research has argued that to be able to best respond to student needs it is important that teachers have an understanding of the levels of understanding of as many students as possible in their classroom (Wiliam, 2017[13]). Balancing between depth and breadth is of course tricky; it can be very time consuming to ask every single student in detail, while whole-class responses may yield insufficient detail or not be entirely reliable (e.g., students raising their hand in line with the majority). Teachers therefore need to think carefully about how they can build a detailed picture of a range of students' thinking while drawing appropriate extrapolations.

Insights from schools:

> ***Whole-class tools such as whiteboards or online response tools** can be powerful for real-time information, though it is not enough to just have a single response – what if they guessed? – so it needs to be paired with follow-up questions or asking for steps to be shown too.*
>
> ***Tasks that facilitate a series of rapid responses can be helpful with certain content**, such as true or false, multiple-choice quizzes, or spot the odd one out, which can be particularly helpful for quickly recalling content in an engaging way.*

Teacher: How to probe to elicit the depth of understanding?

Understanding the reasons behind students' answers can help teachers to correctly identify students' needs (Elliott, V. et al., 2020[2]), as well as more broadly engaging students in cognitively demanding

thinking (Prediger and Neugebauer, 2020[24]; Webb et al., 2019[31]). Prompts that push students to share their thinking can be both in written tasks and delivered as follow-up questions (Webb et al., 2009[32]).

Insights from schools:

> ***In multiple-choice questions, challenge students to differentiate between one correct answer and several wrong answers that are 'nearly correct'****. These types of 'hinge' questions are almost trying to catch students out by gauging their depth of understanding through their ability to identify potential mistakes or misconceptions.*
>
> ***Establish a routine where answers are to be coupled with a justification****, such as consistently prompting students to use sentences such as "The reason for this is…", or providing 'justification boxes' on worksheets for answers.*
>
> ***Give students the answer and see if they can find the question****, so they essentially have to work backwards through the steps.*
>
> ***Tap into the power of pairs****, with students discussing questions in pairs and then randomly calling on these pairs for answers, before asking another pair to evaluate the answer, and so on.*
>
> ***Push students to explain how their answer might change if a certain feature is adjusted****, such as changing the tense of a word or the magnitude of a number.*

Feedback

Feedback is designed to provide students with specific, meaningful information on their current performances in relation to a particular learning goal, with the intention of helping them to close the gap between current and desired performances.

Students should have the opportunity to think about this feedback and act on it, using the specific information they receive to try to move their learning forward. In this respect feedback is an ongoing process and sometimes referred to as a 'loop' or 'spiral': information is provided, it is acted upon, and new information is provided to further close the gap between current and desired performances, and so forth.

Feedback may be provided by the teacher, by a peer with the oversight of the teacher, or involve a student self-evaluating and feeding back to oneself. It may be provided in different formats, such as verbally or written, and it may be provided individually or to groups of students.

Associated Terms: *Feedback loops; Marking; Verbal feedback*

Key research findings

There is a large amount of research around the potential of feedback to enhance students' learning. It can be a very high impact approach if implemented thoughtfully and effectively, as evidenced by large systematic reviews (Newman et al., 2021[8]) and meta-analyses (Wisniewski, Zierer and Hattie, 2020[10]). When done well, evidence suggests feedback can support student learning across subjects and age groups (Newman et al., 2021[8]). Evidence suggests that feedback can be implemented effectively in different ways, such as written, verbal and through digital tools, as well as through peers, though the key is the quality of the feedback, with the role of the teacher in ensuring this quality being essential (Education Endowment Foundation, 2018[33]).

What are some of the key considerations when implementing?

Structuring: Is feedback timely and focused?

Feedback that is provided during, immediately or a short time after the task or learning, tends to be more effective than that provided a long time afterwards (Education Endowment Foundation, 2018[33]). Nevertheless, there is an inevitable degree of teacher judgement because sometimes a slight delay in feedback can be helpful for some tasks by instigating more challenge through how it forces students to recall their previous work (Wiliam, 2017[13]).

A large meta-analysis of 435 studies found that feedback which involved information on the content of the task, the processes or strategies adopted by the student, and sometimes the self-regulation level, was particularly effective for student learning (Wisniewski, Zierer and Hattie, 2020[10]). Instead, a common finding of meta-analyses is that directing feedback towards a student, such as through praise or comparison with others, tends to be less effective than that which is directed towards the task and the learning that students are engaged in (Hattie and Timperley, 2007[34]; Kluger and DeNisi, 1996[15]). Interestingly, this is also supported by research with students on what type of feedback they find helpful; qualitative studies with students in a range of contexts suggests that feedback was perceived of value where there was relevant, focused feedback for student improvement (Kerr, 2017[35]; Peterson and Irving, 2008[36]; Tan et al., 2018[37]).

Insights from schools:

> ***Identify in the student's work one particular area to focus on****, such as a student's use of transition phrases or explaining evidence, that seems to be holding them back and provide specific guidance on how to correctly do this for an example or two in their work.*
>
> ***Cite specific evidence from the student's work in the feedback****, for example circling a problematic sentence or step in a method, so they can see the exact connection between your feedback and their work.*
>
> ***Monitor and give feedback on the go****, quickly noting on student work where something needs more attention, or saying "Look again at this please, and I'll be back in a few minutes to hear what you have noticed", can be efficient and impactful in drawing student attention to where they can improve.*

Students: How can student peer feedback be most helpful?

A recent meta-analysis of 54 studies suggested that peer assessment can be impactful for students' academic performance in a range of contexts, including across a wide range of subject areas, education levels, and assessment types (Double, McGrane and Hopfenbeck, 2019[38]). Moreover, feedback from peers might even be more beneficial when students have the opportunity to both receive and provide feedback according to a recent meta-analysis of 17 studies that investigated the overall effect of online peer assessment on students' higher-order thinking (Zhan et al., 2023[39]).

Insights from schools:

> ***Guide students an assessment rubric*** *and model how to apply it to particular examples to give quality feedback. A class discussion, discussing strengths and areas for development, might also be helpful.*
>
> ***Facilitate a student review of other students' feedback to check it is of high-quality****; after students have exchanged feedback in a pair, can they swap with another pair to see if they all agree?*
>
> ***Audit a sample of the feedback to ensure it is meeting expectations****. Reviewing every piece of feedback is probably impractical but take a select sample and verify that it is supporting student learning. If necessary, share further suggestions on their feedback with the class.*

Teacher: How to ensure students actually act upon and use feedback?

The effort and time that teachers put into providing high-quality feedback as outlined above, needs to be actually used by students to close the gap between where they are and where they need to be (Leahy et al., 2005[40]; Wiliam, 2011[6]). Teachers can create the dedicated time and conditions for this feedback to be effectively acted upon and used by students. This is then more information that can be used for further diagnoses, feedback and adaptation as part of a continuous, ongoing process of learning.

Insights from schools:

> ***Consider when to provide grades*** *to avoid distractions and ensure that students focus on the areas to improve.*
>
> ***Build a clear routine for engaging with feedback in the lesson****, where students know that they have a dedicated amount of time to complete the feedback task. This also communicates the value of feedback; it is not simply given to students at the end of the lesson as a last thing.*
>
> ***Implement some checks on their responses to feedback****, whether it is circulating to scan for task completion, calling on some students for reflections, or students self-marking, so there is a degree of accountability.*

Adapting to student thinking

Teachers use information from diagnosing student learning to inform and align the practices and approaches that they are using in the classroom. The teacher proactively interprets student thinking and uses this to adapt their teaching to better align to student understanding and students' needs. This alignment helps to move students forward from where they currently are in their learning to where they need to be.

Associated Terms: *Scaffolding; Progressing learning; Attending to student thinking; Adaptive teaching*

Key research findings

One body of evidence that is important relates to the impact of studies looking at differentiation. A meta-analysis by Deunk and colleagues (2018[41]) found evidence at the primary level that differentiating teaching and support to students can have a positive impact on maths and language learning, though, as with many meta-analyses in education, the effect sizes are variable. In this study, differentiation was defined as careful progress monitoring coupled with adapting instruction in response to this. One notable finding is that high-quality differentiation does not just happen automatically (e.g., by putting students in groups), but requires a conscious, thoughtful effort from the teacher in terms of their practices and approaches. These findings are echoed in a recent systematic review by Smale-Jacobse and colleagues (2019[42]).

What are some of the key considerations when implementing?

Structuring: How to offer appropriate scaffolds to students?

Even with extensive planning and careful consideration, a teacher will always find that sometimes some, or even all students, need extra support to reach a learning goal. Scaffolds are designed to help close the gap between where students are and where they need to get to, providing a balance between not too much support, but also not too little. Scaffolds can be both remedial, administrated retrospectively at a moment of need, though they also can be pre-emptive in the sense that they may be available should students need them. Empirical work has demonstrated that they are not automatically beneficial but require skill and thought in their implementation (van de Pol et al., 2015[43]), responding to the specific learning needs in the classroom.

Insights from schools:

> ***Keep in mind that the scaffold should not be permanent*** *– consider how can they be faded away so students work increasingly on their own, say by providing the starting steps for a couple of questions before students try to apply this on their own for a question.*
>
> ***Draw upon a range of mediums****, such as using visual prompts like 'fill in the gaps' or diagrams, alongside oral clues that speak out your thinking during a scaffold.*
>
> ***Offer students choice that lets them decide how much of a scaffold they need****, for instance a full or half template that they can choose to use if they are struggling, or the same question where they can try it on their own depending on where they are with their learning.*

D2. Students: Can students support each other's needs in a more tailored way?

Students can also be resources for one another in terms of providing additional support to one another. There is evidence that peer-tutoring in pairs or small groups seems particularly effective when used to review or consolidate learning, rather than to introduce new material (Education Endowment Foundation, 2021b[27]).

Insights from schools:

> ***Organise student-led stations around the room****, each with an assigned 'leader' who has successfully completed a certain aspect of the work. Invite students to go to the station for where they are struggling: "If you are finding this part difficult, come here, if you are finding this part difficult, go here".*
>
> ***Ask students who are pushing ahead in a task to come together to explain and compare*** *their different approaches as a form of extension challenge.*

Teacher: How to balance multiple needs in the classroom?

Teachers claim that efforts to differentiate instruction are time consuming and difficult to prepare and implement (Nunley, 2006[44]). Classrooms are characterised by multiple students each with particular needs, which presents challenges to how adaptation is effectively implemented in an equitable and fair way. In particular, research suggests that adapting to student needs may be particularly hard for novice teachers (van de Grift, van der Wal and Torenbeek, 2011[45]).

Insights from schools:

> ***Invite those who are confident to start working on an activity****, while saying that you are going to demonstrate another example to the whole-class for those who feel less confident and want to practise again. It can work the other way too; if most of the class is struggling with the work, be ready to bring most of the class back together for another whole-class example while others carry on working.*
>
> ***Provide students with videos of key content being explained by the teacher*** *so they can revisit content in the classroom in their own time, or during a lesson potentially too, when they need more support.*
>
> ***Have a check-in table*** *where you are available for students to come for more support if they are stuck.*
>
> ***Keep expectations high throughout****, the goal should be staying the same and the belief that all will get there, it's just some students may be taking a longer route to that end goal.*

Observing the effects on students

A theme that runs across this chapter is that formative assessment and feedback is a continuous and ongoing process. It can be thought of as a 'loop' or 'spiral', with teachers diagnosing learning based on goals, and providing feedback that should be acted upon and used or adapting to student thinking with

their instruction. These then essentially re-start the process again. This continuous process means that teachers are constantly mindful of the signals that students share around how effectively their core practices are working.

Table 6.1 includes some of the key signals that teachers gather to check whether they have achieved the goal that they had intended when adopting that practice. The signals can be thought of as the short-term, in-class manifestation of the long-term knowledge, skills, values and attitudes that teachers seek to encourage:

- **Knowledge:** Students demonstrate that they are aware of the purposes of the tasks or activities, or the potential improvements that they could make after receiving feedback.
- **Skills:** Students are able to self-assess themselves and act upon it, and to provide feedback to others.
- **Values and attitudes:** Students are motivated to go beyond their current understanding of a learning goal and are willing to be open and take risks to progress in their learning.

Table 6.1. Signals on what effective formative assessment and feedback looks like for students in classrooms

	Knowledge	Skills	Values and attitudes
Learning goals	Students understand the purpose of their work and how it connects to their previous learning and own lives.	Students can measure themselves against the specific criteria of the learning goal.	Students show interest in the learning goal and trying to understand more about it.
	Sense of purpose, perspective-taking skills		
	Students understand what successful completion of the learning goal looks like.	Self-regulation	Curiosity, open mindset
	Sense of purpose		
Diagnosing student learning	Students shared detailed and elaborate thinking in their answers.	Students can identify potential misconceptions or mistakes to self-correct their work.	Students are aware of the importance of honestly demonstrating their learning to the teacher.
	Cognitive flexibility, critical thinking	Self-regulation, self-awareness, locus of control	Trust, sense of purpose
Feedback	Students understand the cause of previous mistakes or shortcomings and demonstrate improvement in their learning.	Students can act upon feedback independently.	Students eagerly engage with feedback as a means of progressing.
		Resilience, self-regulation, tolerance for complexity and ambiguity	Sense of purpose, open mindset)
	Problem-solving skills, tolerance for complexity and ambiguity	Students give relevant, quality feedback to peers on their work.	
		Responsibility [towards others], collaboration	
Adapting to student thinking	Students complete increasingly complex tasks as scaffolds are removed.	Students can identify when they need support and additional guidance.	Students are willing to take risks in their learning.
	Cognitive flexibility, tolerance for complexity and ambiguity	Self-awareness, self-regulation, locus of control	Manage risks, adaptability, tolerance for complexity and ambiguity

Note: The signals are based on the contributions from the Schools+ Learning Circle and have been mapped to the 'transformative competencies' of the OECD Learning Compass in green.

Unlocking the potential to use meaningful feedback and assessment

Formative assessment and feedback is shaped by the actions of the teacher in the classroom, but it is also informed by the wider actions at the school- and system-levels. A deeper exploration of its complexity can shed light on ways in which school and system leaders can create more supportive environments for meaningful feedback and assessment.

The foundation for feedback and assessment to be meaningful is teachers' understanding of learners. Teachers' opportunities to interact with students early on in the academic year might be helpful to understand their interests, attitudes and behaviours, build a safe and trusted space for interactions, and facilitate putting the emphasis on their progress in their own learning journey rather than a static picture of performance.

A curriculum that is clear and not overloaded may help teachers in delineating learning goals. Translating the expected curricula into planned lesson units with specific goals can be challenging when curriculum is overloaded, classrooms are heterogeneous, and planning time is limited. In gauging trade-offs between advancing or slowing down the lessons, having clear and aligned curricula and external assessments can help teachers balance the pace of lessons and ensure all students learn what matters most. This raises the connected question of the type of instructional materials that are available. Trusted resources with carefully designed scaffolds and extensions may help teachers align instruction to different levels and paces.

The challenges of diagnosing student learning, providing feedback and adapting to student thinking are likely to be proportionally related to the varying levels of knowledge in the classroom, with class size being a compounding factor. That said, for leaders, it is not only a question of class size to be considered but also composition and the strategic deployment of support staff that can support the formative assessment and feedback process.

Providing teachers with formative assessment tools aligned with curricula, and digital tools for individualised tracking, can aid the diagnosis of student learning too. Similarly, school-level data approaches can provide helpful information for identifying and monitoring at-risk students. Yet, much of the complexity lies in how teachers interpret student thinking in class, and their ability to notice and respond to students can be enhanced through continuous professional learning opportunities, in particular those relating to observation. Similarly, while adaptive resources and digital tools like AI-trained rubrics may facilitate immediate feedback, the crucial relational judgement by teachers continues to play an essential role. Indeed, the need for teachers to consider students' learning profiles and social-emotional characteristics when delivering meaningful feedback means that enabling teachers to build this more tacit understanding of students remains important.

Box 6.2. Schools' strategies to strengthen formative assessment and feedback practices

Calderglen School in Scotland (UK) has focused on developing teachers' systematic use of 'hinge' questions to diagnose student learning at key moments in lessons. School leaders have spent time interrogating the evidence base behind 'hinge' questions through dedicated study sessions together. To help standardise the quality of questions across lessons and subjects, leaders have integrated this into the school's observation protocol for learning walks, facilitating more specific, concrete discussions among colleagues around their diagnosis of student learning.

Kalasatama School in Finland has adopted a co-teaching approach to help teachers better adapt to student needs. Teachers take part in regular professional learning sessions on how to adopt different models of co-teaching that can provide more tailored assistance to students depending on evolving learning needs. In particular, teachers meet weekly to plan for specific co-teaching strategies in lessons, agree on instructional materials to be used, and discuss the progression and needs of students.

At the **Royal Academy** in Bhutan**,** part of HundrED, incoming teachers undergo four to six months of professional learning with experienced mentors in the school to develop their ability to draw upon multiple sources of information to provide meaningful, multi-dimensional feedback for students. Annual expert-led sessions and seminars ensure teachers learn both how to use individualised reviews and daily observations to formatively assess students' academic progress and well-being, and how to use this to craft appropriate, actionable feedback.

In navigating the challenge of enabling high-quality formative assessment and feedback in classrooms, school and system leaders may carefully consider some of the following questions:

- How can school leaders support teachers in balancing clarity and flexibility in curricula to deliver meaningful instruction with clear learning goals? How can these subject-specific learning goals be adjusted to facilitate cross-curricular experiences?
- What student tracking and classroom monitoring data systems exist in the school? What school-level assessment policies exist to monitor and support progress towards these leaning goals, and how do these complement external evaluations? How is external data used to provide a comparative perspective of progress?
- What structures can enable the manageable, impactful use of feedback in lesson time? How can school leaders ensure the consistent impact of diagnosing and feedback strategies across the teaching body in different subjects?
- How much time is provided to teachers for lesson planning and to collaboratively develop resources or tap into resource banks for diagnosis and to support learners with different needs?
- What criteria is used to decide the size and composition of classes? When classrooms are diverse in terms of students' abilities, what additional resources (e.g., second teachers, ad hoc teacher aids) are made available to teachers? Are temporary groupings by ability or extracurricular catch-up lessons available to students?
- How do teachers in every subject and across subjects discuss about the learning profiles and progress of individual students? Are there individual student learning plans? How is students' progress reported, and what synergies are expected between formative and summative assessments?

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Annex 6.A. Summary of considerations and insights for the practices of formative assessment and feedback

Annex Table 6.A.1. Summary of considerations and insights for the practices of formative assessment and feedback

	Structure of the task, activity or content	Role of students	Role of teacher
Learning goals	How can learning goals be communicated clearly and accessibly? • Show the expected outcome. • Draw attention to short-term and long-term goals. • Balance student-friendly language and technical vocabulary.	Do students understand the relevancy of goals? • Explain the logic of the new learning goal. • Include examples of how the goal is relevant and applicable. • Give scope to shape the learning goal. • Challenge students to create an individual goal alongside the class one.	How to revisit learning goals during the learning process to support self-monitoring? • Bring the long-term learning goal back into focus with a student summary. • Encourage a structured way of tracking how goals are being mastered. • Encourage students to redo a piece of work to see their progress towards a goal.
Diagnosing student learning	When is the right time to elicit student thinking in a systematic way? • Gauge how much of the explanation has been processed by a class. • Check if students differentiate between examples with and without a misconception. • Verify the foundations of work are solid before progressing to new ideas.	How to elicit the thinking of as many students as possible? • Pair whole-class tools such as whiteboards with follow-up questions. • Use tasks facilitating rapid responses.	How to probe to elicit the depth of understanding? • Challenge to differentiate between one correct answer and several wrong answers. • Set a routine where are answers are coupled with a justification. • Give the answer and see if students can find the question. • Tap into pairs, with students discussing questions and calling for answers. • Push students to explain how their answer changes if a certain feature is adjusted.
Feedback	Is feedback timely and focused? • Identify a particular area to focus on – use of transition phases or explaining evidence. • Cite evidence from student's work in the feedback. • Monitor and give feedback on the go.	How can student peer feedback be most helpful? • Give an assessment rubric model. • Make students review the quality of feedback in pairs. • Audit a sample of the feedback so it meets expectations.	How to ensure students actually act upon and use feedback? • Consider when to provide grades to avoid distraction. • Build a routine for engaging with feedback in a lesson. • Implement checks on their responses for feedback.
Adapting to student thinking	How to offer appropriate scaffolds to students? • Consider the scaffold should not be permanent. • Draw upon a range of mediums, such as diagrams and oral clues. • Students to decide how much scaffold they need.	Can students support each other's needs in a more tailored way? • Organise student-led stations with a leader that has completed a task. • Ask students pushing ahead to come together to explain and compare different approaches.	How to balance multiple needs in the classroom? • Invite confident students to start working on an activity. • Provide videos with key content being explained by the teacher. • Have a check-in table for support. • Keep expectations high for all students.

7 Moving towards more evidence-informed practices

This chapter considers the substantial progress in research on teaching, whilst noting the ongoing challenges that remain in terms of building a more cumulative body of evidence. It offers an indication of the strength of the best available evidence for each practice. It also highlights the importance of greater synergies between scientific and professional knowledge.

In Brief

- Educational research has grown rapidly in recent decades, prompting questions about how this expanding evidence base can effectively support educational improvements.
- There has been a lot of research on the impact of the 20 practices of the Schools+ Taxonomy on students' cognitive and non-cognitive outcomes. A rating exercise, involving 26 leading academics and knowledge brokerage organisations, showed that the best available evidence is stronger for classroom interaction and formative assessment practices rather than for cognitive engagement, quality subject content, and social-emotional support – partly because these areas are harder to conceptualise and measure.
- Further research is needed to understand what works, where, why, for whom, and under what conditions these practices can be most impactful.
- While schools seem interested in accessing and using research, barriers and challenges remain in interpreting it and adjusting established practices or habits. Deeper forms of collaboration, both among teachers and school leaders, as well as with researchers, around evidence and self-inquiry into one's practice remain limited and often overlooked.
- Greater attention is needed not only on *what* has an impact but also on *how*, fostering a dynamic process where professional experience and scientific knowledge enrich one another.

In the last two to three decades, education research and knowledge production has gone through transformative changes. Rough estimates put the production of educational research papers as increasing fivefold between 1996 and 2015 (Van Damme, 2022[1]). This trend is mirrored in the growth in the quantity of actors that are engaged in working with research evidence. OECD research suggests that the number of studies on knowledge mobilisation mentioning terms relating to "intermediaries" has increased from less than 200 studies in 2000, to over 2500 studies in 2021 (Torres and Steponavičius, 2022[2]). Whilst the growth has not kept pace in scale and efficiency as that of the health sector (Education.org, 2021[3]), there has still been a considerable shift towards building a larger evidence base in education.

This new abundance of evidence has raised fundamental questions to critically understand how it can support education improvement. What counts as evidence? What are the general characteristics of the current evidence on teaching practices? How can understanding the wider interplay between different sources of knowledge influence teachers' decision making and support more evidence-informed practices in the classroom?

Building scientific evidence on classroom teaching

What counts as evidence

The growth in research production raises the question of what counts as evidence. Drawing upon the example of the health sector, defining 'quality evidence' has often been viewed in a hierarchical way with distinct standards based on methodological rigour in terms of identifying causal impact (Glover, 2006[4]; Nutley, Powell and Davies, 2013[5]). It is often presented in terms of a pyramid (Stimson Library Medical Center of Excellence, n.d.[6]; University of Canberra Library, n.d.[7]), with certain methodologies such as meta-analyses and systematic reviews at the top, followed by replications of experimental design studies and randomised control trials. Case studies and qualitative studies are often then viewed as lower quality

evidence (Hoffmann, Bennett and Del Ma, 2017[8]). These can collectively be referred to as 'scientific knowledge', with pyramids of evidence often then including other bodies or forms of knowledge, such as 'professional knowledge' that draws upon sources like 'expert opinion' or 'experiential knowledge' (see Figure 7.1). The former may include information and evidence shared by colleagues during formative evaluation or observation, while the latter may include the more anecdotal and less formal forms of evidence, such as salient student behaviours or direct student feedback, that arise during the day-to-day of lessons, or across the wider school. Because methodologies evolve and change, these pyramids may not be exhaustive and have been criticised for presenting hard boundaries between certain methodologies (Murad et al., 2016[9]).

Figure 7.1. A pyramid of quality evidence based on methodological rigour

Source: Adapted from Van Damme (n.d.[10]), Center for Curriculum Redesign, *The Challenges of Evidence-Informed Education,* https://dirkvandammeedu.net/wp-content/uploads/2024/02/The-Challenges-of-Evidence-informed-Education-CEIPP.pdf, (accessed on 7 August 2024).

In practice, what counts as 'quality evidence' can be understood in different ways. For example, there is a notable variation in how organisations that evaluate and broker education research gauge the quality of evidence for the same intervention programs (Wadhwa, Zheng and Cook, 2023[11]). Moreover, the hierarchical perspective to evidence reflects the tension between establishing causal relationships and developing research that responds to the needs and diverse realities of schools. This has been increasingly focused on in recent years, with there being more effort on encouraging more plurality in how the concept of evidence is approached to reflect that there is no single best method or type of evidence. Rather the most appropriate methodological approach depends on the question that is being investigated (Nutley, Powell and Davies, 2013[5]). Indeed, Nutley and colleagues (2013[5]) have explored this in more detail and have developed an adapted typology of the relative contributions that different kinds of methods can make to different kinds of research questions (see Table 7.1). There have been similar efforts more recently by the Education Endowment Foundation (EEF) (2024[12]) too, who released a guide explaining the different types of evidence and purposes. Such efforts point towards a greater acknowledgement in education

research of the potential multiplicity of approaches to advancing the evidence base of education, from understanding whether or not a particular practice intervention works, to unpacking actually how it may work, and the variability of this in different contexts.

Table 7.1. The appropriate methodologies depend on the research question

Research question	Qualitative research	Survey	Case-control studies	Cohort studies	Randomised control trials	Quasi-experimental studies	Non-experimental studies	Systematic reviews
Does doing this work better than doing that?				+	++	+		+++
How does it work?	++	+					+	+++
Does it matter?	++	++						+++
Will it do more harm than good?	+		+	+	++	+	+	+++
Will students be more interested or engaged in learning?	++	+			+	+	+	+++
Is it worth doing this?					++			+++
Is it the appropriate learning opportunity for these students?	++	++						++
Are students, schools, other stakeholders satisfied with it?	++	++	+	+				+

Note: The number of '+' signs corresponds to the extent to which the type of methodological approach is suited to answering a research question.
Source: Adapted from Nutley, Powell and Davies (2013[5]), *What counts as good evidence? Provocation paper for the Alliance for Useful Evidence*

Measuring teaching and learning is particularly challenging

Measuring teaching and learning is particularly complex. Teaching is never a linear process; instead, many teaching practices typically occur simultaneously, each of which is hard to disentangle and isolate individually (Pollard, 2010[13]; Leinhardt and Greeno, 1986[14]). The intrinsic complexity of teaching is further compounded by the context in which it takes place. Teaching is situated in a specific temporal, social and cultural context. For instance, in the classroom, the process and quality of instruction can vary tremendously from day-to-day (Praetorius, McIntyre and Klassen, 2017[15]; Rowan and Correnti, 2009[16]), and interactions with students can be highly variable too (Schweig, 2016[17]; Reinholz and Shah, 2018[18]).

Research efforts have primarily rested upon indirect measures, such as questionnaires where teachers and students report on the presence or frequency of different teaching practices (Goldhaber, Gratz and Theobald, 2017[19]; Hill, Kapitula and Umland, 2011[20]). These are practical in terms of implementation and cost-effectiveness. They have also been combined with analysis of the frequency and quality of learning experiences that students encounter, such as through analysis of learning resources (Stacey and Turner, 2015[21]). However, these indirect measures have a range of limitations, such as being susceptible to social desirability bias (Goe, Bell and Little, 2008[22]) or misinterpretation (Goe and Stickler, 2008[23]). One approach in response to this has been to move towards more direct measures such as observation (OECD, 2020[24]). However, looking directly into classrooms remains methodologically challenging and very costly, as well as constrained by its own potential limitations such as observer bias or the observation process distorting classrooms behaviours (Praetorius, McIntyre and Klassen, 2017[15]; Ho and Kane, 2013[25]).

Meanwhile, as the use of methodologies with rigorous control groups has become more accepted and common in education, efforts to build evidence on teaching and learning through these has encountered obstacles. One challenge is that research with this type of methodology struggles to build detailed evidence on the effectiveness of teaching practices. Partly this is because, as mentioned, numerous practices often occur simultaneously in classrooms, meaning isolating individual practices is very challenging (Wrigley

and McCusker, 2019[26]). A second challenge connected to this is that there is considerable human agency in classrooms which reduces the possibility that external factors such as an assigned treatment in an experimental evaluation can alone explain effects (Parra and Edwards, 2024[27]). Because human agency is at the heart of learning and many intervention changes, rather than external medicines as in the health sector, the risks of bias are high, such as through the alteration of behaviour by teachers who are aware they are being studied (Thomas, 2016[28]). Finally, generalisability claims can be limited, as classrooms can be far more variable in practice than the labels of characteristics that are typically used and controlled for which might explain the low rates of replicability (Pawson, 2006[29]).

Building a cumulative body of knowledge is even more challenging

These limitations sit across far broader challenges in research production and mediation which impede building a coherent cumulative body of knowledge. An important concern is that the replicability of education research is very low (Perry, Morris and Lea, 2022[30]). Based on a sample of the top 100 education journals in 2014, researchers found only 0.13% of the published papers, in the journals' complete publication history, were replications (Makel and Plucker, 2014[31]). Moreover, Makel and Plucker found in their 2014 systematic review that of the replication studies that did take place, when there was no author overlap in the replication study, only 54% of replications were successful in replicating previous effects. Indeed, the EEF has also encountered similar issues of replicating at greater scale studies that have shown positive effects in certain, smaller settings (Edovald and Nevill, 2020[32]). Furthermore, a follow up review inspired by that of Makel and Plucker but investigating replication studies in the years 2011-2022 found a small increase in the number of replication studies, though similar results and patterns in terms of success (Perry, Morris and Lea, 2022[30]).

The challenges around replication studies point to the potential misalignment between the inherent incentives of research production and what is needed for the development of a reliable and coherent cumulative body of knowledge for professionals to draw upon. One argument has been that the incentives of research production are too heavily geared towards producing results that are statistically significant. This has led to wider criticisms that effect sizes in education research, and more widely, can often present an exaggerated estimate of a programme's effect (Button et al., 2013[33]; Vasishth et al., 2018[34]; Sims et al., 2022[35]). This raises the risk of misinterpretation or misalignment in terms of expectations. Hence, in retrospectively analysing 22 promising randomised control trials, Sims and colleagues (2022[35]) found that the estimated effect sizes were exaggerated by an average of 52% or more. This means that real effects may actually be smaller than those reported, particularly in small-scale trials as is characteristic often of much experimental research in education.

Connected to these questions around the reliability of certain effect sizes is the issue of who is conducting the research. Researchers have found that even when controlling for different design features and other covariates, studies that were commissioned or conducted by the developers of a particular intervention had, on average, a larger effect size than those studies that were conducted by independent actors (Wolf et al., 2020[36]).

A second critique of the inherent incentives in research production has been its dependency on extensive referencing of already well-cited work (Chu and Evans, 2021[37]). It has been argued that this can lead to the 'canonisation' of certain ideas, with some arguing that these referencing patterns are coupled with a culture of rarely challenging or negatively reviewing previous work (Van Damme, 2022[1]). These are trends that affect not only educational research but social science research more generally (Catalini, Lacetera and Oettl, 2015[38]). Manifestations of this can be seen in research into teaching and learning and how certain ideas can become concentrated around well-repeated labels that are often ill-defined, such as the case of 'active learning' as mentioned in Chapter 1 (Hood Cattaneo, 2017[39]), or where there may be far greater focus on discussing the promise and potential of a concept rather than actual empirical work, as has been argued in the field of 'cognitive science' (Perry, Morris and Lea, 2022[30]).

Finally, efforts to synthesise existing evidence and develop more generalisable findings, such as through meta-analyses and systematic reviews that consolidate empirical findings, are still relatively nascent in education. Drawing upon the work of Education.org (2021[3]), Van Damme (2022[1]) recently argued that the health sector produces 26 syntheses for every one synthesis developed in education. Whilst some of this difference can be explained by sectors' expenditure on research, estimates on the magnitude of difference in spending (e.g. OECD, 2023[39]) suggest that other factors than purely funding are also at play. Nevertheless, recent years have also seen the development and establishment of "knowledge brokerage organisations" (also referred often to as "knowledge intermediaries") that enable practitioners' – as well as policy makers' – engagement with research to support their practices and decision making by carrying out knowledge mobilisation activities (OECD, 2022[40]). In particular, many organisations engage in developing robust evidence syntheses. They are relatively new structural features in the education evidence landscape, which serve as established gatekeepers and pathways for rigorous education research. For instance, the What Works Clearinghouse in the United States, EEF in England, The Campbell Collaboration in Canada, and Leibniz Institute for Research and Information in Education (DIPF) in Germany have all become well-established in the last two decades (OECD, 2022[40]).

The scientific evidence on teaching practices

Despite the challenges of measuring teaching and learning, there is growing scientific knowledge on the impact of some teaching practices on students' cognitive and non-cognitive outcomes. After all, it can sometimes be too easy to outright dismiss research findings in a 'blanket', all-encompassing manner due to certain limitations. However, there is still valuable information that can be garnered from the sustained efforts to interrogate teaching and learning in recent decades.

Gauging the strength of the existing evidence

To understand the state of play of the existing evidence base on teaching, an Informal Expert Group (see Table 7.2) examined different pedagogical frameworks and their associated evidence bases to define clear conceptual descriptors for common practices and to draft background documents scoping the evidence on practices. This resulted in a first draft of a Taxonomy of Teaching, consisting of five broad dimensions (Classroom Interaction, Cognitive Engagement, Formative Assessment and Feedback, Quality Subject Content, Social-Emotional Support).

An expert review process was undertaken on the 20 practices included in the Schools+ Taxonomy to better understand the strength of the best evidence available and identify potential areas for further research. Evidence brokerage organisations and a selected group of leading academics were invited to participate in an expert rating exercise for each of these practices (see Annex A). In particular, they were asked to rate each of the 20 practices according to the following considerations:

- the number of existing quality studies establishing a causal impact on student outcomes and building a cumulative body of research;
- consistency of the direction of effects and predictive power over key student outcomes;
- and coverage of a range of different contexts, subjects and ages.

A total of 26 leading academics and evidence brokerage organisations provided ratings. While pinpointing the current strength of evidence is challenging, Table 7.2 provides an initial indication according to the level of expert consensus in the ratings as well as the strengths and limitations that they shared.

Table 7.2. Evidence on causal impact on student outcomes

Pedagogy dimension	Strength of the best available evidence according to expert ratings		
	Low	Medium	High
Classroom interaction		Student collaboration (e.g. Education Endowment Foundation (2021a[41]); Kyndt et al. (2013[42]); van Leeuwen and Janssen (2019[43]))	
		Whole-class discussion (e.g. Howe and Abedin (2013[44]); Alexander (2018[45]))	
		Questioning and responding (e.g. Alexander (2018[45]); Hennessy et al. (2021[46]); Sedova et al. (2019[47]))	
Cognitive engagement	Ensuring appropriate levels of challenge (e.g. Wang and Eccles (2013[48]))	Metacognition* (e.g. Muijs and Bokhove (2020[49]); Perry, Lundie and Golder (2018[50]))	
	Working with multiple approaches & representations (e.g. Mayer (2002[51]))		
	Facilitating first-hand experiences (e.g. Kolb and Kolb (2009[52]))		
	Meaningful context and real-world connections (e.g. Education Endowment Foundation (2017[53]); Alifieri et al. (2011[54]); Furtak et al. (2012[55]))		
Formative assessment and feedback		Diagnosing student learning (e.g. Elliot et al. (2020[56]); Chiu (2004[57]))	Feedback (e.g. Elliot et al. (2020[56]); Newman (2021[58]))
		Adapting to student thinking (e.g. Smale-Jacobse et al. (2019[59]); Deunk et al. (2018[60]); van de Pol et al. (2015[61]))	Learning goals (e.g. Jussim and Harber (2005[62]); Sanchez et al. (2017[63]))
Quality subject content	Crafting explanations and expositions (e.g. Stockard et al. (2018[64]))	Clarity, accuracy and coherence (e.g. Stockard et al. (2018[64]); Coe et al. (2020[65]))	
	Making connections (e.g. Education Endowment Foundation (2017[53]))		
	Nature of the subject (e.g. Erduran and Dagher (2014[66]))		
Social-emotional support	Relationship building (student-student) (e.g. Yibing Li et al. (2011[67])	Nurturing a supportive classroom climate (e.g. Wang et al. (2020[68]); Khalfaoui, Garca-Carrin and Villardn-Gallego (2020[69]))	
	Explicitly teaching and actively practising social-emotional skills (e.g. Education Endowment Foundation (2021b[70]); Takacs and Kassai (2019[71]))	Relationship building (teacher-student) (e.g. Hamre and Pianta (2001[72]); Ansari, Hofkens and Pianta (2020[73]))	

Note: An independent literature review was also carried out which referenced 500 studies across the five teaching goals considered. The key references noted for each practice were suggested by the Informal Expert Group.
*Metacognition was added to the Taxonomy after the Consultation exercise with experts and knowledge brokerage agencies. It is positioned based on a review of the literature and some of the qualitative comments relating to metacognition from experts and knowledge brokerage agencies.

The level of scientific knowledge varies greatly across these practices according to experts' judgements. Overall, there is more consensus around the causal impact of practices in the dimensions of classroom interaction and formative assessment and feedback than those of cognitive engagement, quality subject content, and social-emotional support.

Limitations and areas for further research

Table 7.3 suggests specific aspects requiring further investigation for each one of the practices in each of the five dimensions of the pedagogical taxonomy. Overall, the following limitations can be noted across the evidence base:

- **Number of studies and research designs.** There is a limited number of research studies using empirical designs. For instance, in formative assessment and feedback, more empirical research is needed to isolate the effects of certain practices. Similarly, in social-emotional support, where correlational and non-experimental studies prevail, empirical research is required to understand the precise impact of teacher-student relationships and their direct contributions. There is also a wider question of the type of empirical research; more controlled out-of-classroom studies (e.g. laboratory studies) can play a role in building a picture of the effects of practices and how they may work, but there remains a need to carefully consider their translation to authentic classrooms which is not always direct (e.g. see Howe et al., 2019[73]).
- **Education levels.** Research disproportionately comes from some age groups and education levels for some dimensions. Notably, in social-emotional support, there is a need to further investigate how findings on the effectiveness of concrete practices with younger students translate to older students when explicitly teaching skills. Conversely, in quality subject content, there is still a need to better understand how cognitive learning theories manifest particularly in younger students, in relation to the core practice of clarity and accuracy.
- **Subjects.** Research tends to be carried out in the subjects of mathematics, literacy and science which limit the relevance of findings to other subjects. For instance, in the dimensions of quality subject content, the evidence base is quite heavily dominated by research in the field of science and mathematics, for nature of the subject and in, cognitive engagement, in science for first-hand experiences.
- **Contexts.** Research tends to overrepresent well-resourced and English-speaking educational contexts, compared to those serving disadvantaged or marginalised students. This is particularly notable in studies on core practices such as collaboration and whole-class discussion where class composition plays a significant role in the manner that these practices are implemented. More diverse research contexts are needed to better understand how findings apply across different classroom settings to improve the generalisability of their results so far.
- **Conceptual clarity.** In some dimensions, there remain challenges in operationalising certain constructs. For instance, in the social-emotional support dimension there can be a high degree of conceptual variation in terms of how aspects such as the classroom climate or specific skills that may be taught are defined and used in research (Steponavičius, Gress-Wright and Linzarini, 2023[74]). For other practices, such as in cognitive engagement, there is need for more clarity around what constitutes 'challenge'. A lack of clarity on key constructs makes it challenging to build cumulative knowledge in the field.

More concrete limitations of current research studies are indicated in Annex 7.A to pinpoint existing gaps and opportunities for future research efforts.

Table 7.3. Potential future research directions

Pedagogical dimension	Practice	Areas for further research
Classroom interaction	Questioning and responding	What types of questions may be most effective for promoting more advanced forms of reasoning, like critical thinking or problem-solving. The timing, and, connected to this, sequencing, of questions (Bishop, 2021[75]).
		The specific emotional or affective aspects of the learning environment and how they interact with questioning.
		Further understanding the cultural variation of certain questions and how they may be interpreted differently, including how certain cultures of responding may impact questioning and responding patterns (Xu and Clarke, 2019[76]).
	Collaboration	Contextual differences in terms of class sizes and composition.
		More independent evaluations of interventions (Education Endowment Foundation, 2021a[41]).
	Whole-class discussion	Contextual differences in how discussion and dialogue emerge, and how these are related to cultural practices (Xu and Clarke, 2019[76]).
Cognitive engagement	Ensuring appropriate levels of challenge	Greater conceptual clarity and coherence around what constitutes a 'challenge'.
		Isolating the exact mechanisms – analysis, evaluation, problem-solving etc. – that make particular work/tasks challenging (Sweller et al., 2024[77]). This may include the identification of certain concrete features of work/tasks challenging.
	Facilitating first-hand experiences	Isolating particular effects of experiences; research interventions often consist of multiple program elements making it challenging to understand what features make them impactful (Sweller et al., 2024[77]).
		Understanding the most effective use of first-hand experiences in relation to student prior knowledge and when to progress to inquiry processes from certain levels of prior knowledge (de Jong et al., 2023[78]; Sweller et al., 2024[77]).
	Working with multiple approaches and representations	What types of representations or different perspectives may be of value to different students in terms of deepening their understanding and building more flexible thinking.
	Metacognition	Working with larger sample sizes to improve the generalisability of findings. This may be connected to trying to understand in more detail the particular mechanisms of particular metacognitive approaches that contribute to outcomes.
		The relationship between in-the-moment metacognition and retrospective metacognition (often referred to as "online" or "offline" metacognition) as some studies have found a disconnect between these types of measurements and suggest there is more to understand how these are developed (Fleur, Bredeweg and van den Bos, 2021[79]).
	Meaningful context and real-worlds connections	More clearly defining and understanding what is 'meaningful' and 'relevant' to students, to identify specific features for task design and teaching. This may include consideration across subjects.
Formative assessment and feedback	Learning goals	Empirical testing of different features of learning goals and their communication to understand if certain approaches are more effective than others.
	Diagnosing student learning	What specific tasks and questions can best diagnose student learning in real-time for different types of knowledge and, for new, increasingly valued skills.
		When it is most appropriate to elicit student thinking and act upon it (Ruiz-Primo, 2011[80]).
	Feedback	The long-term impacts of different types of feedback (e.g. long-term memory retention).
	Adapting to student thinking	Advancing approaches to the measurement of the degree of adaptation of teachers to student thinking and their alignment to student needs (Deunk et al., 2018[60]).
Quality subject matter	Crafting explanations and expositions	Moving from a primarily theory-based approach towards more empirical testing of how explanations of particular content are best structured and sequenced for students' long-term learning.
	Clarity, accuracy and coherence	More classroom-based research of particular learning theories, such as around retrieval of prior knowledge and its sequencing, as well as in-classroom cognitive load.
	Making connections	Understanding more about sufficient levels of prior knowledge to move towards making connections (Education Endowment Foundation, 2021a[41]).
	Nature of the subject	How the 'nature of the subject' can be conceptualised and analysed beyond scientific subjects (Puttick and Cullinane, 2021[81]).

Pedagogical dimension	Practice	Areas for further research
Social-emotional support	Nurturing a supportive classroom climate	Conceptual clarity around key concepts (e.g. grit and consciousness) to ensure a consistent application of terminologies (Gutman and Schoon, 2013[82]; Audley and Donaldson, 2022[83]; OECD, 2021[84]). This will also facilitate measurement efforts.
	Relationship building (teacher – student)	How relationships are developed and maintained in different cultures and contexts to facilitate comparisons.
		More experimental research that goes beyond correlational, survey-based designs (Sabol and Pianta, 2012[85]).
	Relationship building (student – student)	Further exploration of how to structure learning environments to facilitate conversation and dialogue (Alfieri et al., 2011[54]; Wentzel and Watkins, 2022[86]).
		The role of group work in relationship building, and how it might contribute to students' sense of belonging (Tolmie et al., 2010[87]).
	Explicitly teaching and actively practising social-emotional skills	Understanding how to support social-emotional skill development with older populations of students, particularly adolescents (Yeager, Dahl and Dweck, 2017[88]).
		Role of non-classroom spaces (e.g. corridors) in social-emotional skill development (Jones et al., 2021[89]).
		Examination of specific mechanisms within programmes to isolate what contributes to student effects.

Note: Suggestions were provided by the 26 leading academics and knowledge brokerage organisations participating in the expert review exercise. An additional 17 academics and organisations provided qualitative input on the conceptualisation of practices and the scoping of their evidence (see Annex A: Methodology).

Moving towards more evidence-informed practices

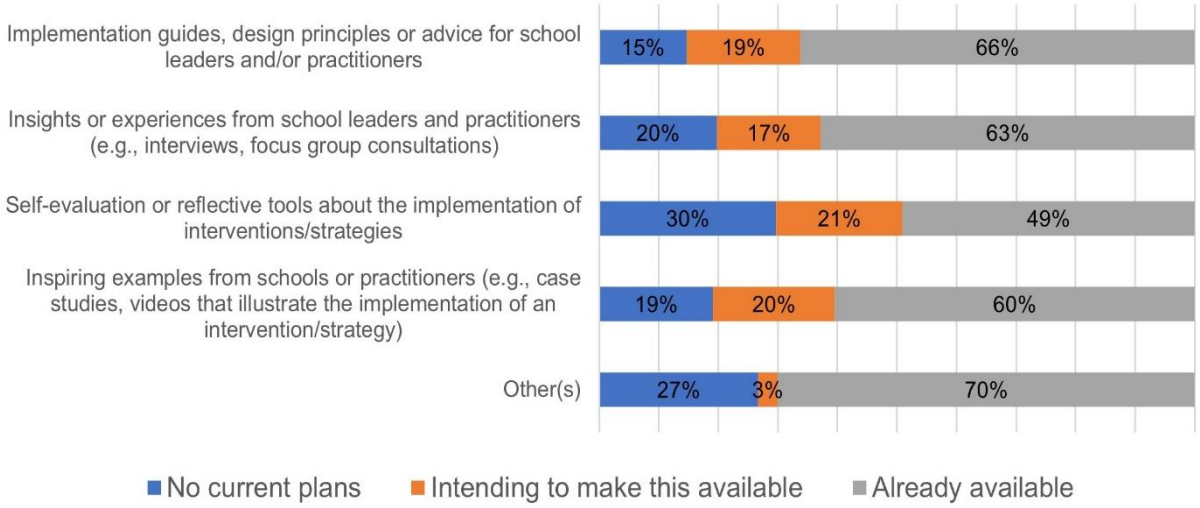
As research seeks to move the frontiers of knowledge in education forward, this raises the question of how this body of scientific knowledge can best inform what happens in the classroom. For scientific knowledge to have an impact, teachers need to be able not only to access and interpret it, but also to unlearn and draw upon new evidence in their decision making processes (Cain et al., 2019[90]). This is a dynamic and complex process.

Accessing scientific evidence

The efforts to translate research into more accessible ways for schools have increased in recent years. It has become clear that the simple access to 'raw research' is not generally an effective way for it to be used (Gorard, See and Siddiqui, 2020[91]). The aforementioned growth in knowledge brokerage organisations reflects this, as well as the increasing attention to understanding their role and activities as intermediaries (OECD, 2022[40]; OECD, 2023[92]).

A recent OECD survey of knowledge brokerage organisations from 34 countries looked at the types of support organisations provide practitioners. The survey included formal knowledge brokerage organisations and other actors such as research institutions, initial teacher education institutions, inspectorates and quality assurance services. Only about half (49%) of the organisations who said that their knowledge mobilisation work in education focuses on facilitating research use in practice reported that 'Self-evaluation or reflective tools about the implementation of interventions/strategies' were already in place for practitioners. As Figure 7.2 shows, 21% intended to make this type of support available. On the one hand, this suggests that supports for teachers' critical engagement with interventions/strategies are not yet fully established. The dialogue that is necessary around research evidence use and professional reflection could be further supported. Second, this suggests that the perspective of practitioners is still not systematically sought nor considered. How teachers would evaluate the effectiveness of interventions or strategies is not consistently an area of consideration.

Figure 7.2. Types of support organisations enabling research engagement offer to practitioners



Note: The number of respondents to each item shown in the Figure varied: item 1 had 225 respondents, item 2 had 223, item 3 had 222, item 4 had 225 and item 5 ('other') had 30 respondents.
Source: OECD Survey of Knowledge Mobilisation in Education data, 2023.

StatLink https://stat.link/s10ix5

There has also been a change in the attitudes and consumption of teachers and school leaders towards scientific evidence. In the Teaching and Learning Survey (TALIS) 2018, 76% of teachers reported attending "education conferences where teachers, principals and/or researchers present their research or discuss educational issues" (75%) (OECD, 2019[93]). In contrast, in the first Teaching and Learning Survey (TALIS) in 2009, less than half of teachers reported attending a similar form of professional development ("Education conferences and seminars").

This echoes wider findings on evidence engagement among the profession, with research in several countries confirming the presence of some promising patterns around teachers' and schools' access scientific evidence (Brown and Malin, 2022[94]). A 2017 survey of 1670 teachers in England found that the majority of respondents had a positive disposition towards academic research, even if its actual impact on their decision making was still small relative to other sources of knowledge (Walker, Nelson and Bradshaw, 2019[95]). Meanwhile, two-thirds (65%, n=318) of Australian educators in the Q Project's first survey indicated that, 'when confronted with a new problem or decision, they look for research that may be relevant'. The same proportion (65%, n=318) indicated they 'know where to find relevant research that may help to inform their teaching practices' (Australian Institute for Teaching and School Leadership, 2021[96]). Interestingly, this blend of positive disposition but more limited direct application of research is also echoed in research in Spain; in one study, 68% of teachers declared that they frequently or always use research to inform their practices, but its actual use to inform innovations was less, with experiential or peer knowledge preferred (Ion, Diaz and Gairin, 2019[97]), cited in Malin et al. (2020[98]).

Across these different geographic areas of research, a notable feature is the role of colleagues and community. Indeed, more widely, the role of colleagues in sharing evidence is also increasingly seen as important to not just enabling access to evidence but also influencing and facilitating its use (Cain, 2015[99]). For instance, research has found that teachers often prefer to be recommended evidence by their colleagues, underpinned by the understanding that their colleagues would only recommend evidence they found to be useful or relevant to practice themselves (Williams and Coles, 2007[100]).

Box 7.1. Towards more structures and cultures of high-quality research use among schools

Growth in research production in recent decades has also seen growth in the types of initiatives that seek to support the effective use of this research by teachers and school leaders. These efforts range from building specific structures such as processes and mechanisms for research use to developing wider cultures of habitual interrogation of research evidence to inform decision making.

Across the Schools+ Network, participants grapple with this challenge of promoting effective evidence use. Some notable approaches include:

- The main brokerage organisation in England (UK), the Education Endowment Foundation (EEF) has undergone a considerable growth journey since its foundation in 2011. This has seen it grow from its original focus on randomised control trials and meta-analyses for its Teaching and Learning Toolkit, to also become the largest funder of qualitative research in their country. To better support schools to access, understand and use evidence, the EEF set up a partner network ("Research Schools Network (RSN)") in 2016. The RSN has grown to a collaboration of 33 schools across seven regions in England. Research schools serve as evidence advocates in their local and regional networks and develop strategic partnerships through a blend of training, exemplification and school-to-school support. The RSN has collectively engaged with more than 40% schools across England and provided training to over 6,000 schools, with its role in fostering stronger cultures of evidence use reflected in the wider fact that 70% of senior leaders in England cite use of the EEF's Toolkit when making decisions about school spending.
- SUMMA is the Laboratory of Education Research and Innovation for Latin America and the Caribbean, created in 2016 by the Inter-American Development Bank. SUMMA aims to enhance the quality, equity, and inclusion of educational systems by generating comparative research, synthesising contextualised evidence, designing and evaluating innovations, and fostering effective structural reforms, through long-term policy and practice partnerships. One manifestation of this its development, in alliance with the aforementioned Education Endowment Foundation, of a Platform of Effective Pedagogical Practices to support both evidence-informed and context-sensitive decisions. Thus, the platform complements global evidence with regional research from the Latin America and Caribbean region to ensure both consistency in what the evidence states, and pertinence in its recommendations for practical actions. A further important strand of SUMMA's work relates to its support of policy reforms and building shared policy and research agendas. It supports and collaborates with more than 20 Ministries of Education in the region. For example, at the regional level it has collaborated with the University of the West Indies to reform initial teacher training programmes in the Caribbean to support new teachers' research literacy and their understanding of the latest evidence base of practices.
- Leerpunt is a knowledge brokerage organisation in Flanders, Belgium that aims to strengthen educational practice through scientific insights. Founded in 2022, it has been able to build on the work of other brokerage organisations – such as the two toolkits of the EEF – as well as key lessons learnt. For instance, one notable strategy has been its development of a clear knowledge agenda in collaboration with schools, which outlines the themes where teachers and education professionals indicate a need for more knowledge. This is with a view to keeping research highly relevant to schools. Another notable strategy is its development of a range of partnerships to foster a network of support around schools that can better enable effective evidence use. Leerpunt collaborates with other organisations, such as teacher training programs and pedagogical support services, as well as partnering with the Flemish

Education Agency. This more 'system' approach to knowledge mobilisation reflects the growing knowledge base not just in terms of evidence itself, but actually on how to support evidence use.

- Edutopia.org, an initiative of the George Lucas Educational Foundation, serves as a free source of information on evidence-informed learning and teaching practices and connects a community of stakeholders committed to improving education. It aims to advance a vision where students become lifelong learners and develop fundamental skills for today's and tomorrow's challenges. Its content – a blend of multimedia stories, videos, and articles written by practitioners – features inspiring examples from real classrooms. Through vehicles like its "The Research Is In" newsletter, Edutopia helps translate educational research for practical application by educators. The platform has developed considerable reach, particularly in North America and increasingly globally, with an average of 12 million people reached each month across Edutopia.org and social platforms. Key to its success has been highlighting promising practices in clear, accessible formats, many of which are tied closely to the realities of the classroom and highly relatable.

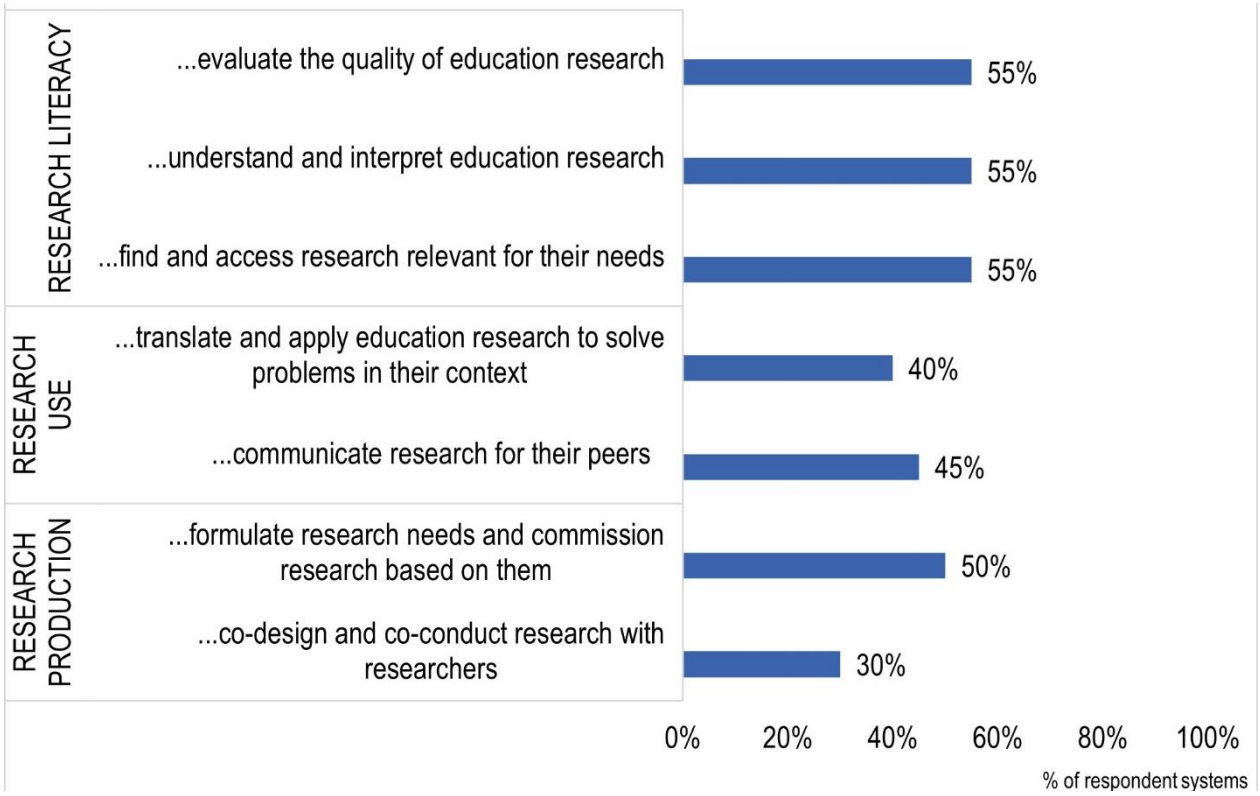
Note: Input was provided directly from Schools+ participants.
Sources: EEF (2022[101]), *Teaching and Learning Toolkit,* https://educationendowmentfoundation.org.uk/education-evidence/teaching-learning-toolkit.; Gu, Q. et al. (2020[102]), https://educationendowmentfoundation.org.uk/public/files/RS_Evaluation.pdf.; SUMMA (2023[103]), *Effective Education Practices Platform*, https://practicas.summaedu.org/en/what-is-it-platform/what-is-it-main-objectives.; Sutton Trust (2024[104]), *News and Findings - NFER; School Funding and Pupil Premium 2024*, https://www.suttontrust.com/our-research/school-funding-and-pupil-premium-2024.

Interpreting and assessing scientific evidence

Schools have a growing interest in accessing and using research. However, have they the skills and capacity to effectively engage with it, and even contribute to it? In 2021, the OECD Strengthening the Impact of Education Research policy survey found that 62% of respondent education systems reported that a "lack of time to access and engage with research" was a barrier to the use of research in school practice, whilst just over half (53%) of respondent education systems reported that "low levels of skills and capacity to use research" were a barrier to the use of research in school practice (OECD, 2022[40]). This is particularly significant when considering how rapidly fields of research on teaching can evolve; for instance, consider the wealth of attention on metacognition (Muijs and Bokhove, 2020[49]) or practices relating to social-emotional support (Yeager, Dahl and Dweck, 2017[88]; Yeager et al., 2021[105]) in recent years, which can shift the knowledge base teachers must draw upon.

Figure 7.3. Practitioners' research engagement skills

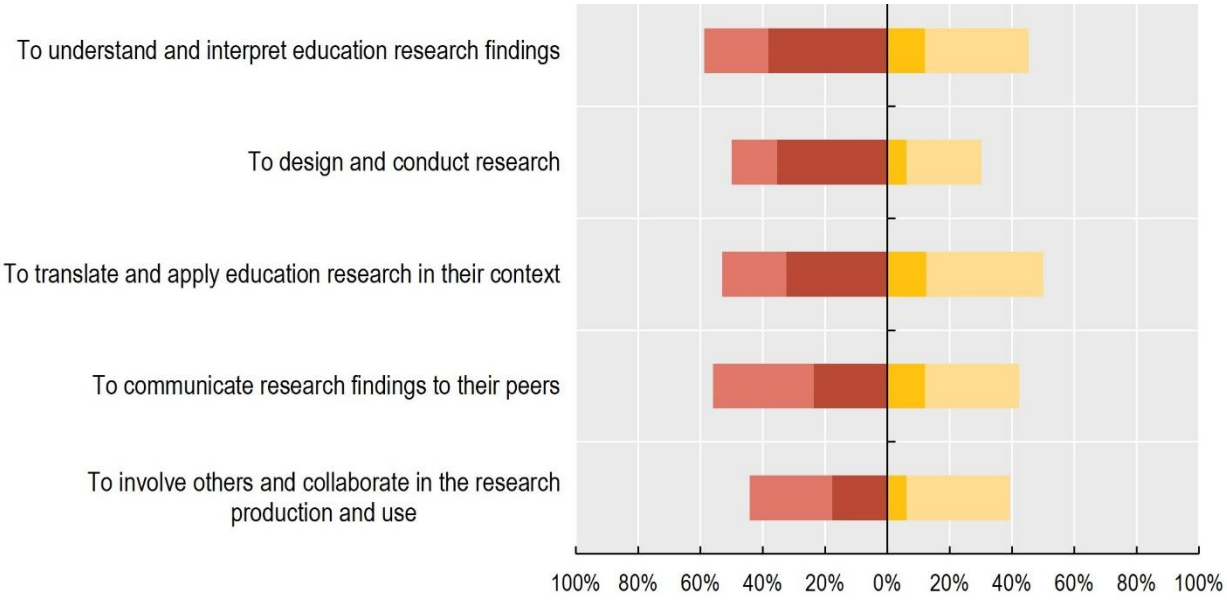
Percentage of systems agreeing or strongly agreeing that *"Practitioners have the skills and capacity to…"*



Note: The OECD's Strengthening the Impact of Education Research project surveyed 37 education systems from 29 countries in 2021. 20 systems responded to this question on practitioners.
Source: Adapted from OECD (2022[40]), *Who Really Cares about Using Education Research in Policy and Practice?: Developing a Culture of Research Engagement, Educational Research and Innovation*, https://doi.org/10.1787/bc641427-en.

Initial teacher education programmes and professional development opportunities are two important avenues to develop a teaching and leadership workforce that can effectively engage with education research. The aforementioned OECD survey found that only around one-third of the ministries reported that training future teachers to understand and interpret research findings is required in all Initial Teacher Education programmes, and less so in Continuous Professional Development (OECD, 2022[40]).

Figure 7.4. Skills taught in initial teacher education and continuing professional development

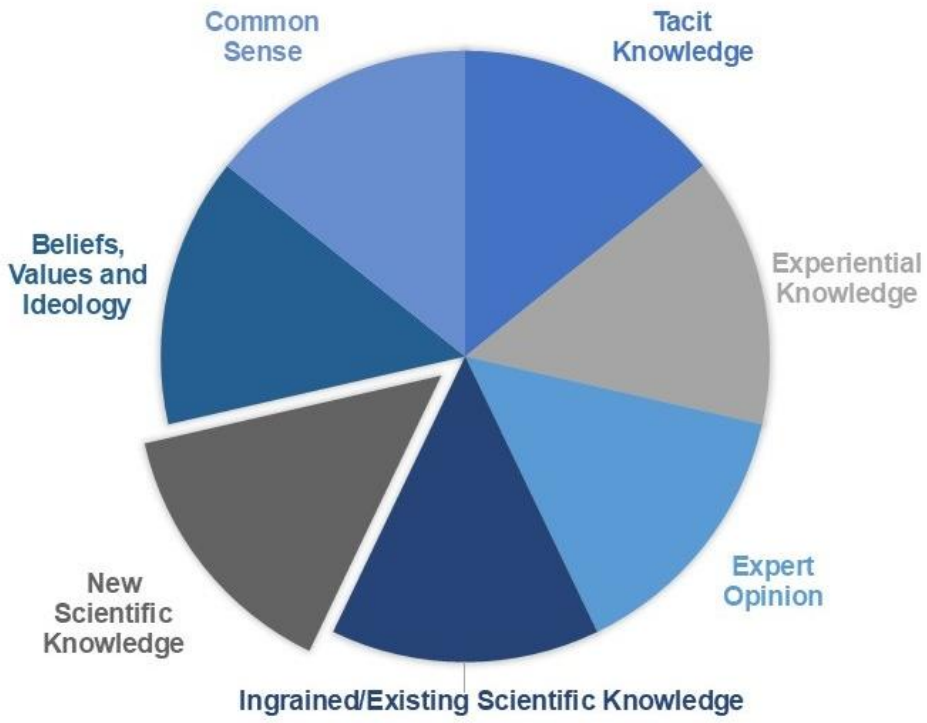


Notes: Data show the percentage of respondent systems that reported the given skills as "required" or "mostly covered" by Initial Teacher Education (ITE) and Continuous Professional Development (CPD). N = 34 for ITE, 33 for CPD. See *Who Really Cares about Using Education Research in Policy and Practice?: Developing a Culture of Research Engagement* (OECD, 2023[92]) for more details. Skills are ranked in descending order of the percentage of systems reporting them as "Required" in ITE.
Source: OECD (2022[40]), Strengthening the Impact of Education Research policy survey, https://doi.org/10.1787/bc641427-en

Unlearning and relearning

The very challenges of the process of changing practice cannot be overlooked. It is one that can demand unlearning and relearning what may be deeply seated habits or beliefs. For evidence to have any impact, it must be integrated into teachers' internal knowledge bases, enabling them to draw upon it in decision making (Cain et al., 2019[90]). Teaching is informed by a range of knowledge sources, and when new evidence is encountered, teachers need to engage in an unlearning and relearning process. When scientific evidence is of high quality and high relevance to teachers, it can be an invaluable source of information (Van Damme, 2022[1]; OECD, 2022[40]). But, it is one source of knowledge that interacts with other sources of knowledge (Figure 7.5) (Cain, 2015[99]; Sharples, 2013[106]).

Figure 7.5. The different sources of knowledge that may inform teachers' decision making and their teaching



Source: Adapted from Van Damme (2022[1]), *The Power of Proofs (Much) Beyond RCTs,* www.curriculumredesign.org, and Guerriero (2017[107]), *Pedagogical Knowledge and the Changing Nature of the Teaching Profession,* https://doi.org/10.1787/9789264270695-en.

This interplay needs to be further understood, with its neglection making the relevant efforts at the system-level to move towards more evidence-informed practices all the harder. Research has not shed enough light into "how" scientific evidence actually imposes itself and changes practice. It has been proposed that when evidence is sought to solve a problem or inform deliberation, it is more likely to result in changes in practice rather than when it is just consulted out of curiosity (Farley-Ripple et al., 2018[108]). This emphasises that evidence is combined with context-bound tacit knowledge or practice-based research to address specific problems (Greany and Maxwell, 2017[109]; Earl and Timperley, 2015[110]). After all, consider how research on providing students with opportunities to revisit previous learning must be combined with the specific knowledge a teacher has of how the previous lessons have progressed as the teacher organises the clarity, accuracy and coherence of a lesson and how to use specific summaries or plenaries.

Because of the difficulty of the change process, researchers argue that evidence use needs to be understood as a social process, with interaction and relationships playing key roles in determining how evidence is applied in practical settings. On the one hand, Sharples (2013[106]) and Brown et al. (2021[111]) highlight the opportunity to discuss research and evidence allows practitioners to gain a deeper understanding and sense of ownership over the findings. This discussion enables the more relevant and sensitive integration of evidence into professional settings.

On the other hand, a collaborative approach to evidence use embedded into organisational procedures and culture can also facilitate the actual change of practices which is inherently challenging and needs to be sustained over a period of time (Cain et al., 2019[90]; Sharples, 2013[106]; Levine and Marcus, 2010[112]). Effective evidence-informed practice in schools depends on collaborative processes and school-wide

structured approaches, which can help ensure that evidence use becomes an ongoing practice (Godfrey and Brown, 2018[113]). Moreover. the structures and cultures that can be created at the school-level are also informed by the wider system context. Rather than relying on schools pioneering impactful use of evidence use, they can also be supported by the system actors around them that can both enable and enhance their approaches to evidence (OECD, 2022[40]). Evidence-informed teaching, therefore, requires a clear commitment to collaboration and shared learning, rather than being an isolated endeavour (Darling-Hammond, Hyler and Gardner, 2017[114]).

The importance of school culture that promotes the use of evidence was underlined by an impact evaluation in England by Coldwell and colleagues (2017[115]) which revealed that sustained change occurs when teachers are given time for informed debate and opportunities to see the impact of evidence in practice. This finding underscores the arguments made on considering evidence use as an iterative process that unfolds in stages, involving the implementation of new practices or changes to existing ones, followed by impact assessment (Harn, Parisi and Stoolmiller, 2013[116]). Moreover, this is reinforced when considering the very nature of practices; the effective implementation of practices such as Student collaboration and whole-class discussion can be aided by the presence of strong norms and routines, which take time to build.

The iterative, ongoing approach to evidence use that research describes means that teachers must be attentive to the different salient outcomes that this evidence use yields, and reflective on what this means. Accordingly, it increasingly means moving towards a position where teachers need to be viewed as, essentially, researchers of their own practice. In particular, considering the power of school cultures and collaboration, it may be more appropriate to talk about teachers in the collective sense; hence, communities of teachers that are researching their practice, drawing upon evidence critically and informatively as well as their wider individual and collective professional expertise.

Box 7.2. Understanding and recognising the professional knowledge among the profession

Some pioneering efforts have arisen to highlight the initiatives that schools have developed to address specific challenges. In general, these aim to surface and celebrate achievements, share effective strategies, and foster collaboration with a view to fostering a culture of excellence and ongoing learning.

- One manifestation of this has been the development of repositories of practices and initiatives that aim to speak directly to schools. There are some examples of this operating at the national level. The Ministry of Education in the Slovak Republique has developed a Catalogue of Innovations in Education, which aims to inspire schools and educational institutions for further growth and development. Priority is given to initiatives that have robust experimental results and that have already been tested in Slovak schools. The catalogue also, however, includes initiatives that have been successfully used abroad, and some completely new ones that are still waiting to be evaluated. Initiatives are categorised based on type of practice (e.g. assessment methods, management) and the target group or type of school. An overview of the content focus, methods and conditions for its use is also provided, as well as the necessary steps for its introduction somewhere new and the findings from evaluations.
- There have also been some initiatives to do develop repositories of schools' initiatives the international level. HundrED, a global non-profit organization, searches for and shares inspiring 'innovations' in K-12 education. Each year, HundrED selects 100 'impactful and scalable' education innovations from around the world and supports their spread to new contexts through an online platform. HundrED's online platform features about 700 innovations which have been selected from thousands. A clear selection process underpins

this work, including shared criteria that are used by a range of selected reviewers. To capture the process of context-informed design-thinking and ongoing refinement that has led to the development of these initiatives, the platform shares the step-by-step implementation process behind innovations.

- Another approach that has grown in recent years has been the use of awards to shine a light on the work of the teaching profession. At the national level, many countries now award annual national or sub-national teacher or school prizes organised by public authorities or private entities. There are about 40 or so national teacher prizes affiliated with the Varkey Foundation's Global Teacher Prize, organised by a range of public and private actors. Some of these also operate at the international level, with large monetary prizes. The T4 organisation's 'World's Best Schools' identifies schools who are implementing projects in five thematic areas with a prize each of 50 000 USD.
- Similar efforts to recognise teachers' work have been spearheaded by a range of other actors, from government ministries (e.g. Ministry of National Education for France's Ordre des Palmes Academiques or Canada's Prime Minister's Award for Teaching Excellence), non-profit organisations (e.g. AdvanceHE in the UK), teachers associations (e.g. the National Science Teachers Association in the US), to universities and higher education institutes among others. An ongoing challenge across prizes is creating mechanisms through which the initiatives or approaches recognised can be systematically shared to a wider number of teachers and schools.

Note: Input was provided directly from the Ministry of Education of the Slovak Republique.
Sources: Mackenzie, N. (2007[117]), Teaching Excellence Awards: An Apple for the Teacher?, https://doi.org/10.1177/000494410705100207; Seppala and Smith (2019[118]), Teaching awards in higher education: a qualitative study of motivation and outcomes, https://doi.org/10.1080/03075079.2019.1593349.

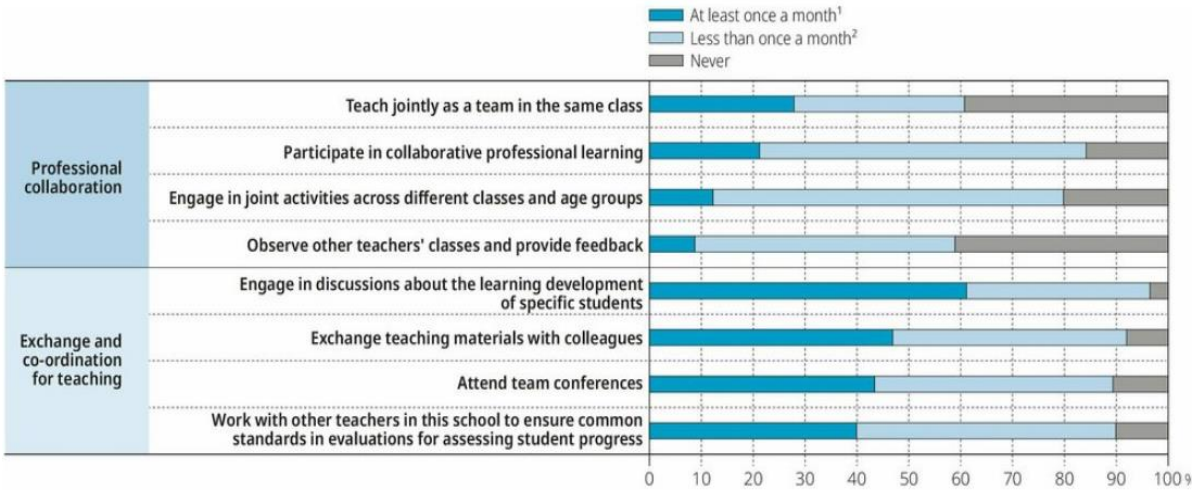
Opportunities to research their own practice and contribute to further research

An inquiry stance towards one's own teaching can be significant for a teacher's practice and growth. It has been argued that this type of constant self-inquiry is essential to long-term refinement of something as complex as teaching (Hiebert et al., 2007[119]). There are a range of methodological approaches to practice-based research, including action or participatory research or research partnerships (Maxwell and Greany, 2017[120]), as well as professional learning communities (PLCs) (OECD, 2022[40]; Stoll, 2015[121]).

More broadly, a challenge, however, remains ensuring that forms of collaboration that are deeper and more meaningful are the norm in schools and systems. These may serve as helpful foundations for rich professional inquiry into practice among teachers. The OECD's TALIS survey (OECD, 2019[93]) suggests that while collaboration is common, deeper forms of collaborative practice remain limited in many schools (Figure 7.6).

Figure 7.6. Teachers' collaboration with colleagues

Percentage of lower secondary teachers who report engaging in the following collaborative activities in their school with the following frequency (OECD average-31):



Notes: "At least once a month" covers the following response options: "1-3 times a month", "Once a week or more". "Less than once a month" covers the following response options: "Once a year or less", "2-4 times a year", "5-10 times a year". Values are grouped by type of collaborative activity and, within each group, ranked in descending order of the collaborative activities in which lower secondary teachers report to engage at least once month.
Source: OECD (2019[93]), TALIS 2018 Database, Table II.4.1, https://doi.org/10.1787/19cf08df-en.

The relevancy of a more inquiry-orientated, self-reflective approach to teaching also appears particularly relevant for strengthening teaching skills related to the 20 fundamental practices that are considered in this report. As Chapter 1 outlined, it is not so much a case of teachers overhauling what they are doing in their classrooms, but rather building effectively on the existing foundations of the fundamental practices that exist (OECD, 2020[24]). It is more about interrogating one's practice to understand what and how can be improved in a given context.

Beyond the immediate benefits to the teacher, there are also two notable areas in which it could further strengthen the larger, collective knowledge base of education. First, this could lead to strengthen the base of the education knowledge by codifying professional knowledge (Professional Knowledge in Figure 7.3). The different sources of knowledge that may inform teachers' decision making and their teaching.

Professional knowledge is often seen as difficult to generalise, and there has been little effort to codify and synthesize this type of expertise. Professional knowledge has always been, and will be, somewhat intangible, due to its localised nature and dependency on experiences (Ulferts, 2019[122]; Guerriero, 2017[107]), but recent years have also seen the tools and means for examining the commonalities of this knowledge (Mulgan, 2024[123]).

Moreover, practice-based research could also help provide greater clarity on the needs and relevance of more rigorous research methodologies. A recent policy survey by the OECD found that practitioners' involvement in research production was primarily a passive one, remaining as the archetypal 'object' of research (OECD, 2022[40]). On the research side, there has been more attention to teachers' experience and perspective during the implementation of interventions and changes, such as through aspects like 'process guidance' which aim to translate research findings for a school audience in a way that is actionable (Cartwright, 2013[124]). Yet, at a time of experimentation and change, such as for example during COVID or the emergence of generative AI, rapid research from schools could provide insight into more rigorous

evaluations to inform policy responses. This could build greater efficiency and responsiveness into the system and, significantly, support practitioners in periods of change.

There is a paradigm shift in research away from focusing simply on a ‘one way’ model of research findings being ‘pushed’ onto schools and teachers, to one that considers ‘two way’ exchange in a far more complex and sustained fashion (OECD, 2022[40]; Sharples, 2013[106]). Imagine that schools are asked about the future research agenda to ensure that scientific knowledge is relevant and aligned to their immediate needs. Similarly, making the professional knowledge of implementation explicit may provide inspiring examples of how to balance fidelity and contextual adjustment during the implementation process for other schools to consider.

Moreover, certain patterns may exist across this body of professional knowledge which could help inform further research on the critical components of their implementation, helping to build a more granular evidence base. Together, this can mean evidence that is more likely to be adopted, implemented well, and, thus, impactful, and at greater scale. The complex interplay of practitioners and researchers and their respective knowledge can be seen as a feedback loop that can heighten the effectiveness of both scientific and professional knowledge, and how they work together to ensure high-quality teaching.

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Annex 7.A. Overview of the features of the 'Strengths and Limitations of the Evidence Base'

Annex Table 7.A.1. Summary of strengths and limitations of the core teaching practices of the Schools+ Taxonomy

Schools+ taxonomy			Breakdown of notable strengths and limitations					
Dimensions	Sub-dimensions (Taxonomy 1.0)	Proposed level of evidence	Number of studies & research designs	Consistency of findings	Education levels primarily considered P: Primary school contexts S: Secondary school contexts	Subjects primarily considered M: Maths Lit: Literacy Sci: Science	Contexts primarily considered H: High resource contexts L: Lab-based studies R: Range of contexts O: Older studies S: Small-scale studies SP: School-based Programmes	Priority questions for a future research agenda
Classroom interaction	Collaboration	Solid	Solid number of meta-analyses and other studies with a range of research designs.		P	M Sci Lit	H	There remains a need for further independent evaluations.

Schools+ taxonomy			Breakdown of notable strengths and limitations					
	Whole-class discussion and dialogue	Solid	Solid number of large-scale correlational studies with reasonably consistent findings. Recent large-scale RCT with positive impact.		P	M Sci Lit	H	How this practice works for diverse student backgrounds.
	Questioning	Strong	Large number of studies with a range of research designs, with reasonably consistent findings across different student contexts.				O R	What are the effects of specific types of questions. How combinations of questions work together.
Cognitive engagement	Ensuring good levels of challenge	Solid	Some correlational observation studies, but one limitation is the conceptual variation in how 'challenge' is defined in these studies. Some evidence from experimental designs.				L	Greater conceptual clarity. How to measure cognitive engagement. What are the exact mechanisms that drive cognitive engagement.
	Fluency and flexibility	N / A	As per Table 2, to be re-conceptualised with Quality of Subject Matter					
	Metacognition	Solid / Strong	Solid number of meta-analyses and other studies with a range of research designs.					Greater understanding of the subject-specific nature of certain mechanisms
	Working with multiple perspectives	Solid	Some robust empirical studies on dual-coding theory. Theoretically can be a high-risk practice if confounded with less evidence-informed approaches such as learning styles.			M Sci	L	Understanding the effects of the practice in a greater range of subjects.

Schools+ taxonomy			Breakdown of notable strengths and limitations					
	Facilitating first-hand experiences	Promising / Solid	Some robust empirical studies with young students showing positive outcomes.	Some mixed results with older students.	P	Sci		Understanding the effects of the practice with older students, and across a range of outcomes (e.g. learning, motivation).
	Meaningful context and real-world connections	Promising	Some robust empirical studies. Question of measuring 'meaningful'.	Variation in the findings with some showing it makes little difference. Some variation by age groups too.				How to measure 'meaningful'.
Formative assessment and feedback	Learning goals	Strong	Large number of studies with a range of research designs, from a number of years.				R	Empirical testing of different types of learning goals.
	Eliciting student thinking	Solid	Solid number of primarily correlational studies. Some recent robust empirical studies.				R	Understanding in more detail the role that different types of eliciting, including tasks, play in driving effects.
	Feedback	Strong	Large number of meta-analyses and other studies with a range of research designs, from a number of years.				R	The long-term effects of different types of feedback on memory retention.
	Aligning to student thinking	Solid	Solid number of primarily correlational studies, from a number of years. 'Aligning' can be conceptualised and operationalised differently in studies.				R	How to measure alignment of teaching for larger-scale studies.
Quality of subject matter	Explanations and making expositions	Promising	Some correlational studies, but difficult to isolate the exact role of explanations. Solid number of studies on using worked examples and variation theory.				H S	More precisely defining what makes a high-quality explanation.
	Nature of the subject	Promising	Some small-scale empirical studies.			Sci M	H S	Larger-scale empirical work to understand the effects on

Schools+ taxonomy			Breakdown of notable strengths and limitations					
			Limited number of robust empirical studies.					different student outcomes.
	Making connections	Promising / Solid	Solid number of studies from psychology and theoretical studies.			M	L	Understanding exactly which connections in subject matter are of value.
	Exploring patterns and generalisations	Promising	Limited number of robust empirical studies.					
			Merged as per Table 2.					
	Explicit procedures and methods	Promising	As per Table 2, to be re-conceptualised with Explanations and Making Expositions					
	Clarity and accuracy	Solid	Solid number of correlational studies on the presentation of well-structured, coherent content.			M	L	Understanding the features of well-structured content in a greater range of subjects.
			Solid number of studies on the sequencing of content and learning opportunities, with reasonably consistent findings.					
Social-emotional support	Creating a supportive classroom climate	Solid	Some large-scale correlational studies.	Mixed findings around certain constructs (e.g. perseverance and growth mindset).				Greater conceptual clarity.
			Some meta-analyses showing positive outcomes.					How to measure common constructs such as respect and warmth.
			One limitation is in the variation of how climate is conceptualised.					How climates may vary by different subjects.
	Relationship building (student-student)	Promising / Solid	Some robust empirical studies on cooperation, supported by some qualitative studies.	Some variation in the findings on cooperation, but consistency in qualitative studies.			R	How to measure relationships.
			Question of measuring relationships.					
	Relationship building (teacher-student)	Solid	Some large-scale correlational studies, with both student and teacher perceptions of positive relationships predicting positive outcomes.				R	How to measure relationships.

Schools+ taxonomy			Breakdown of notable strengths and limitations					
	Explicitly teaching and actively practising social-emotional skills	Promising / Solid	Some robust empirical studies and some meta-analyses.	Mixed findings with older students.	P		SP	How generalisable certain findings are to older students.

Note: Ratings on the levels of evidence were provided by the 26 leading academics and knowledge brokerage organisations participating in the expert review exercise. Participants were also invited to share qualitative input on the rationale behind their ratings too. An additional 17 academics and organisations provided qualitative input on the conceptualisation of practices and the scoping of their evidence (see Annex A: Methodology).

1. Ratings were defined as follows: (i) Emerging: The evidence is primarily theoretical and there is limited robust empirical evidence, or the evidence is limited to specific contexts and/or students; (ii) Promising: The research base is developing and showing promise, but there may still be a greater reliance on theoretical rather than robust empirical studies including experimental studies, and/or a high degree of variation in studies. There may only be a limited number of contexts represented in studies; (iii) Solid: The research base is solid with a good number of robust empirical studies including experimental studies, and a solid understanding of how effects may vary across different contexts; and, (iv) Strong: The research base is strong with a large number of robust empirical studies including experimental studies, and a high degree of consensus around the mechanisms that drive outcomes and how these vary in different contexts. There are observational and cross-sectional studies that feed into the evidence base too.

8 Empowering high-quality teaching in every school

This chapter explores ways for schools and system leaders to support teachers in growing their practice and providing contexts that enable high-quality teaching, and how these two might intersect. By examining these in a more granular way with the lenses of different practices, it charts how a more nuanced understanding and approach to fostering teacher growth may be possible that reflects the complexity of teaching.

In Brief

- Teaching is innately complex, with this complexity hinging upon the teacher's ability to enact practices and the wider school context that can facilitate or hinder this implementation.
- Practices present different levels of difficulty when it comes to implementing them effectively. Expert ratings from schools suggest that some practices (e.g. ensuring appropriate levels of challenge, explicitly teaching and actively practising social-emotional skills) are more difficult than others (e.g. learning goals, building teacher-student relationships). A more nuanced understanding of professional development and growth needs – informed by the demands that individual practices present– may support the better implementation of practices.
- The wider environment also shapes what is possible in the classroom. Expert ratings from schools also suggest that some practices are more influenced by contextual factors (e.g. facilitating first-hand experiences) than others (e.g. diagnosing student learning). School and system leaders play a key role in developing a supportive environment that facilitates the effective implementation of these practices.
- Improving the quality of teaching demands not only helping teachers to refine their practice, but also involves creating a supportive environment where great teaching can thrive.

Teaching has long been seen as a "black box". Practice has historically remained a very private space, with classroom doors largely closed to the observation and scrutiny of colleagues. It has been challenging for researchers to directly measure what happens in the classroom and build a detailed picture of what truly matters for high-quality teaching and learning. Reforms at the system-level have often failed to make a meaningful impact in the classroom and substantially improve student outcomes. If anything, these challenges have, however, led to a recognition of the inherent complexity of teaching.

This chapter explores ways for schools and system leaders to support teachers in growing their practice and providing environments that enable high-quality teaching, and how these two might intersect. It does so by looking into what makes individual practices complex through the lenses of the teacher and the school context in order to shed light on moving towards more targeted, concerted improvement efforts.

Embracing the complexity of teaching

This report has looked into five key teaching goals, examining the best evidence available for 20 practices that teachers can draw upon to achieve them and exploring how they are enacted to fully understand their complexity. The insights shared by the participating expert schools have shown that the complexity lies both in the teachers' ability to enact the practice and the wider school environment. While it may seem counterintuitive to separate these two elements, this approach has already been well-established in fields requiring a similar "clinical" methodology. In sports, for example, athletes train based on a detailed understanding of their abilities, as well as the specific contexts in which they compete. In medicine, significant advances have been made by separately studying the functioning of various body systems from environmental factors.

Some practices are more difficult to enact

Understanding which practices are particularly difficult and why can help to support efforts, both from teachers and school leaders, as well as wider policy makers or teacher educators, to improve these

practices. The difficulty of teaching stems from its unpredictability. It is highly relational, hinging upon the interactions of the teacher and students, as well as between students themselves. Even with extensive planning, teachers cannot anticipate how these interactions will unfold (Clough, Berg and Olson, 2009[1]; Jackson, 1990[2]). There is thus an inevitable degree of flexibility and adaptiveness demanded in teaching. This means that teaching is characterised by a need to make decisions 'on-the-go' in the classroom, with little time for deliberation or reflection. These decisions are thus contingent on the particular context and learning unfolding in the classroom and cannot be fully informed by research or prescribed. Moreover, these decisions come in high numbers (Jackson, 1990[2]), further adding to the challenge of teaching.

Some teaching practices are inherently more difficult to enact than others. To determine the level of difficulty, 132 teachers and school leaders of Schools+ participating schools were asked to provide an expert rating on the difficulty of enacting each of the 20 practices examined for a master teacher. Teachers and school leaders were asked to consider the extent that each practice was dependant on a high level of professional knowledge, adapting to and addressing evolving student needs, and engaging in cognitively demanding multitasking and balancing different sources of information.

Table 8.1 presents practices according to their level of difficulty, based on expert ratings provided by schools. There was reasonable consensus among schools on the relative difficulty of practices, with schools identifying certain practices that are less difficult to effectively enact, and others that were more difficult. These groups indicate the typical inherent difficulty of a practice. However, it is helpful to view the boundaries between groups as flexible, as difficulty can vary; some practices may be especially challenging with a particular class or on certain days, for example. Similarly, caution is required when interpreting the level of difficulty; there might be issues with how practices are conceptualised or how challenging it is to isolate that particular practice from the context.

Table 8.1. The perceived level of difficulty for a master teacher

Difficulty	Practices
Higher	• Working with multiple approaches and representations • Metacognition • Ensuring appropriate levels of challenge • Explicitly teaching and actively practising social-emotional skills • Making connections • Adapting to student thinking • Facilitating first-hand experiences
Medium	• Questioning and responding • Meaningful context and real-world connections • Clarity, accuracy and coherence • Diagnosing student learning • Feedback • Nature of the subject
Lower	• Crafting explanations and expositions • Building student-student relationships • Nurturing a supportive classroom climate • Student collaboration • Whole-class discussion • Learning goals • Building teacher-student relationships

Note: The table is based upon a sample of 132 school leaders and teachers from 85 participating schools in the Schools+ Learning Circle. Teachers and school leaders were asked to rate from 1 to 7 "What is the level of difficulty for an expert teacher to execute this practice, regardless of contextual factors?" for each of the 20 practices. Practices were organised based on the following boundaries for groups, where x represents the mean average rating across raters: lower difficulty $x < 3.2$, medium difficulty $3.2 \leq x < 3.7$, higher difficulty $3.7 \leq x$. The distribution of ratings was also considered when organising practices. Raters had an average experience of 19 years working as a teacher, with the full profile of the raters and further information available in the Technical Appendix.

The school environment shapes what is possible

Environmental factors set the boundaries of educational possibilities in the classroom. When uncovering the complexities of teaching and the difficulty of different practices, a clearer picture can also emerge of the differing extents to which these practices are shaped by contextual factors. No matter how skilled and experienced the teacher, the school environment still shapes the quality of teaching that is possible in their classroom.

School leaders play an important role in shaping teaching and learning in schools (Rodrigues and Ávila de Lima, 2021[3]). School-level policies and practices can support or hinder high-quality teaching. Meanwhile, it should not be forgotten that impactful school leadership – just like impactful teaching – does not happen in a vacuum but is shaped by a range – and increasing range – of wider stakeholders too. Such stakeholders are also important actors when it comes to reflecting and discussing how to build even better schools that will, in turn, be characterised by better teaching too.

Table 8.2 presents practices based on how much they are influenced by context, according to expert ratings from schools. The context seems to have a particularly high level of influence on building student-student relationships, ensuring appropriate levels of challenge, explicitly teaching and actively practising social-emotional skills, and facilitating first-hand experiences. However, these levels of influence are only indicative, and variations in how practices are conceptualised, along with the complex interactions of different contextual factors, could alter their influence on teaching.

Table 8.2. The perceived level of influence of contextual factors on teaching practices

Level of influence	Practices
Higher	• Explicitly teaching and actively practising social-emotional skills • Facilitating first-hand experiences • Building student-student relationships • Ensuring appropriate levels of challenge
Medium	• Metacognition • Working with multiple approaches and representations • Nurturing a supportive classroom climate • Making connections • Student collaboration • Whole-class discussion • Adapting to student thinking • Meaningful context and real-world connections • Nature of the subject • Feedback
Lower	• Crafting explanations and expositions • Questioning and responding • Diagnosing student learning • Clarity, accuracy and coherence • Building teacher-student relationships • Learning goals

Note: The table is based upon a sample of 132 school leaders and teachers from 85 participating schools in the Schools+ Learning Circle. Teachers and school leaders were asked to rate were asked to rate from 1 to 7 "What is the level of influence of contextual factors (external to the expert teacher) on this practice?" for each of the 20 practices. Practices were organised based on the following boundaries for groups, where x represents the mean average rating across raters: Lower contextual influence $x < 4.0$, medium contextual influence $4.0 \leq x < 4.5$, higher contextual influence $4.5 \leq x$. The distribution of ratings was also considered when organising practices. Raters had an average experience of over 19 years working as a teacher, with the full profile of the raters and further information available in the Technical Appendix.

The interplay of teaching and contextual complexity

Together, the teacher and the environment, shape what type of teaching is possible in the classroom. Table 8.3 presents the ratings for both the level of difficulty of practices and the level of influence of contextual factors, which are bookended by two extremes:

- Embraceable anywhere: Practices that are not too inherently difficult to implement, and that are not heavily influenced by the role of contextual factors. These are practices such as setting clear learning goals. Novice teachers 4are likely to master them regardless of their school context.
- Difficult and context-bound: Practices that are inherently difficult to implement and heavily influenced by a supportive environment. The effective implementation of these practices in a high-quality form depends at least on master teachers who have had opportunities to reflect and grow their skillset, as well as school leaders who enable them through a supportive environment.

Table 8.3. The level of difficulty and influence of the school environment on practices

Level of difficulty of practices	Level of influence of the school environment		
	Lower	**Medium**	**Higher**
Higher		• Working with multiple approaches and representations • Metacognition • Making connections • Adapting to student thinking	• Ensuring appropriate levels of challenge • Explicitly teaching and actively practising social-emotional skills • Facilitating first-hand experiences
Medium	• Questioning and responding • Clarity, accuracy and coherence • Diagnosing student learning	• Meaningful context and real-world connections • Feedback • Nature of the subject	
Lower	• Crafting explanations and expositions • Learning goals • Building teacher-student relationships	• Nurturing a supportive classroom climate • Student collaboration • Whole-class discussion	• Building student-student relationships

Note: The table is based upon a sample of 132 school leaders and teachers from 85 participating schools in the Schools+ Learning Circle. Teachers and school leaders were asked to rate from 1 to 7 "What is the level of influence of contextual factors (external to the expert teacher) on this practice?" and from 1 to 7 "What is the level of difficulty for an expert teacher to execute this practice, regardless of contextual factors?" for each of the 20 practices. Practices were organised based on the following boundaries for groups, where x represents the mean average rating across raters: lower contextual influence $x < 4.0$, medium contextual influence $4.0 \leq x < 4.5$, higher contextual influence $4.5 \leq x$; lower difficulty $x < 3.2$, medium difficulty $3.2 \leq x < 3.7$, higher difficulty $3.7 \leq x$. The distribution of ratings was also considered when organising practices. The Technical Appendix also shows the full results of the ratings including the frequency that certain practices were reported by raters as being particularly hard to rate.

In between, there are practices that are more or less likely to be enacted in their highest quality form depending on the teacher and the context. Combining the difficulty of practices and the influence of wider environmental factors can build a more granular understanding of the efforts needed for improvement. For instance, for schools struggling to build healthy, positive student-to-student relationships in their classrooms, there may be a need to thoroughly examine what contextual levers at the school level may help transform the wider environment and help teachers with this practice. Alternatively, those schools

seeking to further students' metacognition in their classrooms may need to dedicate more attention to both the wider school environment and how to engage teachers in a sustained, iterative way in refining this practice due to the specific challenges it poses. Similarly, concentrated efforts to support teachers' mastery of particular practices may be particularly relevant for schools seeking to support how teachers enact practices such as diagnosing student learning in real-time teaching.

Underlying the deeper reflection and analysis of practices that these groups can prompt is a shared appreciation of what different practices offer. A practice being less difficult does not mean that it is not an important part of the teacher's repertoire. After all, the 20 practices have been identified based on their contribution to student cognitive and non-cognitive outcomes. Understanding the difficulty of different practices is not trying to erase or diminish the role of certain practices. Rather, it is a case of understanding more about where and what types of support may be assigned that can better reflect some of the differences between what practices entail and demand.

Building excellent teachers and schools

Numerous studies have explored ways to build a high-quality profession ensuring that teachers are the best prepared possible for their classroom challenges (OECD, 2016[4]; Ulferts, 2021[5]; Schleicher, 2011[6]). This building process is a collective endeavour in which multiple stakeholders are involved and that stretches over time, beginning at initial teacher education and recruitment into the profession, and running through to the ongoing cycle of learning and professional growth in and outside of schools.

In general, this rests, however, upon a primarily blanket approach to teaching practices which assumes that each practice places the same type of demands on teachers. For instance, a considerable area of attention has been what particular features or mechanisms of in-service professional learning may support higher-quality teaching, with it proving challenging to build strong, consistent evidence on improving practice and/or student outcomes (Gore et al., 2017[7]; Sims et al., 2021[8]). Despite calls to tie professional learning opportunities more closely to school contexts (Armour and Yelling, 2007[9]; Desimone, 2009[10]) and the teaching of specific content (Hill, Beisiegel and Jacob, 2013[11]), it is rarer to see consideration of what different features or mechanisms may mean in terms of their development of specific practices. As understanding of the value of certain features or mechanisms grows, such as modelling of new practices or rehearsing them (Sims et al., 2021[8]), this raises the question of how these may interact with the different demands of practices. Moving towards a more granular examination of the different challenges that practices present can help to build a more nuanced understanding of what the further refinement of these practices by teachers entails.

Providing teachers with strong foundations

Teachers' levels of knowledge have a considerable influence on their teaching and, in turn, student learning (Hill, Rowan and Ball, 2005[12]; Ulferts, 2019[13]; Baumert et al., 2010[14]; Keller, Neumann and Fischer, 2016[15]). Their knowledge is dynamic and malleable; it is informed by their learning prior to entering the profession and by their Initial Teacher Education programmes, but also continues to change through different formal and informal learning experiences. Knowledge is typically organised in terms of a teachers' content knowledge, general pedagogical knowledge and pedagogical content knowledge (Ulferts, 2019[13]):

- Content knowledge may, for instance, shape how a teacher brings in the nature of their subject, or how they make connections that are rich and detailed between the content matter. Importantly, this is also true in terms of their 'wider' content knowledge, such as how social-emotional skills function; it is challenging to explicitly teach social-emotional skills without a solid foundation in what these skills consist of.

- General pedagogical knowledge may manifest in how they go about nurturing a supportive classroom climate to motivate students and ensure they feel a sense of belonging, or in how they use questioning and responding strategies to probe for justifications. This type of knowledge may also manifest in the teacher's role as a facilitator during different forms of classroom interaction, such as student collaboration and whole-class discussion.
- Pedagogical content knowledge, which is often seen as how a teacher integrates their knowledge of content in a particular subject with their teaching strategies, could influence a practice such as ensuring appropriate levels of challenge or working with multiple approaches and representations. In both cases, the teacher may need to carefully consider students' prior learning and how to appropriately progress students, as well as considering real-time scaffolds to adapt to students.

Teachers also bring to the classroom their own beliefs, attitudes and values. After all, teaching is a profession which over 90% enter from a position of purpose and mission (OECD, 2019[16]). Teachers' perceptions of students and education might play a role in setting expectations from students might also be linked to the levels of challenge that are considered appropriate or the extent to which teachers' draw on classroom diversity to ensure meaningful contexts. Teachers' own socio-emotional skills may also have an influence in how they go about explicitly teaching certain skills and sometimes even whether they consider this as part of their job when it is not prescribed in the curriculum.

Another important category of beliefs is the teacher's beliefs about him or herself. Their sense of self-efficacy may play a large role in shaping certain practices. For instance, those that demand a higher degree of student agency and less teacher control, such as student collaboration or first-hand experiences, may be informed by a teacher's sense of self-efficacy and, specifically, their levels of confidence when it comes to managing the classroom space. More broadly, teachers' mindsets can determine their level of openness to unlearn and relearn the same practices or to embrace new ones.

A more nuanced understanding of professional development and growth needs

Opportunities for professional development and growth play an important role in taking teachers' foundational knowledge, skills and attitudes further. Taking into consideration the level of challenge that each practice might pose to each individual teacher and the schools' teaching staff can lead to a deeper discussion around what type of professional development and support might be most effective to enhance them.

The practices considered of lower difficulty – which, as mentioned though it warrants being reiterated, does not mean unimportant – present different demands when it comes to supporting these practices to be effectively enacted. These are practices where system policies as well as the early years support for novice teachers can make a difference:

- **Ensuring basic content knowledge is present:** One pattern that characterises some of these practices is primarily a need for adequate levels of content knowledge. For instance, crafting explanations and expositions heavily depends on having recourse to appropriate content knowledge. Whilst they may require some adaptation and in-class decision-making, for instance based on the contributions of students during an explanation, their successful implementation, and thus difficulty, hinges upon teachers' full mastery of what they are explaining or the content they are seeking to connect.
- **Investing early on in getting to know students and developing routines:** Whilst a detailed knowledge of students takes time (e.g. their individual and collective strengths etc.), there may be scope for teachers to rapidly and intensely build their knowledge of students and, accordingly, effective foundational relationships with students, say with a new class or a new arriving student. Similarly, certain practices may be a focus with a new class to ensure the early establishment of routines. Hence, as these are practices that are typically less difficult, they may be open to

becoming more routinised. For example, practising entering and exiting from student collaboration or the types of questions that students can pose one another when collaborating may become more regular features of lessons through particular routines. In particular, teachers may be supported to adopt routines that are already in place for certain practices across the school. The latter can draw upon the existing habits of students and collective expectations to ensure effective implementation, which may also create more cognitive space for the teacher to focus more attentively on more difficult practices.

- **Ensuring that teachers are up-to-date with the latest scientific knowledge:** Practices like learning goals or whole-class discussion, whilst not challenging to implement, require teachers to understand what it actually looks like in its highest quality form. For instance, teachers need to be aware of motivational theory and how learning goals may impose a ceiling on students if communicated in a certain way. Similarly, understanding research on different forms of dialogue and the types of norms or prompts that can stimulate richer learning interactions is highly relevant. Whilst effectively mobilising the latest research evidence on fundamental practices will always be relevant, certain areas may be particularly in need of this type of mobilisation.

In contrast, there are other practices that are more situated, highly relational, and highly sensitive to student needs, helping teachers to master these practices is about a more nuanced, responsive and sustained approach that helps teachers build and hone their situational judgement. One characteristic of some of these more difficult practices is a strong need for in-class decision-making in response to evolving student needs. Take ensuring appropriate levels of challenge or adapting to student thinking as examples, both demand being highly attuned to immediate dynamics of the classroom. Another notable characteristics is that practices demand a specific type of robust knowledge coupled with a flexibility to respond to student needs; for instance, choosing when and where to make appropriate connections between the content as learning progresses, or to bring in additional representations and approaches that stretch but do not overwhelm students, or identifying opportunities to integrate alongside content the teaching and practising of social-emotional skills.

The innate difficulty of these practices suggests that an ongoing focus to develop these is important. Whilst teachers can never exhaustively prepare for such situations and all the permutations they may present, there is nevertheless an argument for a sustained focus on these practices to support teachers to consider a range of different situations that they may encounter. Some examples of ways opportunities for teachers to reflect on practice include:

- **Classroom observation:** Opportunities for teachers to observe their peers and to collaboratively discuss about particular instances where situational judgement arises may be highly relevant. This is something that had already been found to be effective when it comes to teachers' noticing of student learning through the form of video clubs observing practice (Gamoran Sherin and van Es, 2008[17]; Kersting et al., 2012[18]). This is highly relevant for thinking about practices such as diagnosing student learning and adapting to student thinking. Similarly, it may be highly relevant for considering how teachers provide in the moment progression of challenge. Where classroom observation is not possible, case studies or vignettes might be a promising way to develop teachers' ability to perceive and interpret features of the classroom (Atanasova et al., 2024).
- **Mentoring:** Mentoring between teachers, particularly for those new to the profession, is an area of promise for improving teaching (Rockoff, 2008[19]). Particularly demanding practices may serve as particularly fruitful areas of focus for mentoring efforts between more accomplished teachers and those that are new to the profession. This may enable the thinking process behind teachers' judgement to be more clearly elucidated and imparted. In particular, this may help some of the necessary conditions for effective mentoring to be met, such as clear understanding on the purposes and scope of the mentoring (Spooner-Lane, 2016[20]). Moreover, it is worth noting how

mentoring relies on the existing resources that exist in a school or system, making it a potentially very efficient strategy.

- **Professional reflection and collaboration opportunities: Ensuring** that there are periodical opportunities for teachers to exchange on these difficult practices. For instance, planning for professional learning or exchange around these practices across the school year to sustain attention but also respond to evolving levels of skills in these practices. This may manifest in terms of dedicated space for department colleagues to interrogate how they make connections or work with multiple representations and approaches, including the scaffolding of these and their progression.
- **Research their own practice:** Teachers can also engage in more formal inquiry into their practice. This has been an area of increasing attention in recent years, including so-called 'action research' initiatives that see teachers examine specific research questions – on their own or in collaboration with colleagues or external actors (e.g., researchers, community actors) – in their particular classroom context (Feldman et al., 2018[21]), as well as more school-level initiatives such as data-driven professional learning communities to address self-identified school problems (van den Boom-Muilenburg et al., 2023[22]). Some notable features include an iterative and adaptive inquiry process as understanding of the issues at hand evolves, high levels of teacher ownership, and a focus on bridging theory with practice. Whilst a broad field, efforts to evaluate the effects of such teacher-led inquiry initiatives have shown promising results, including in terms of teacher learning and changes to practice (Kamarudin and Mat Noor, 2023[23]; Poortman and Schildkamp, 2016[24]; Manfra, 2019[25]).

It is important to note, as illustrated by the above examples, that most forms of professional reflection on challenging practices involve engaging in professional dialogue with colleagues. This collaborative approach to improving teaching enables educators to challenge and support each other, fostering collective professional growth. The benefits of a school-based approach to professional learning extend beyond mutual support; they are particularly effective due to their direct relevance to teachers' daily challenges and their sustained presence over time. Although the idea of professional communities learning together in their particular school setting is a long-standing concept, its realisation still remains limited in many contexts (Mészáros, 2024[26]).

While improving teaching might be a collective effort, it is also important not to lose sight of teachers' individual needs. Teacher professional development plans, integrating consideration of these practices into formative observations and professional goal setting, may help to keep an attentive lens on these practices and reinforce the message of the need for regular reflection around their effectiveness. It may be that these more challenging practices are encouraged as a focus for teachers' self-inquiry in self-initiated research projects, so that they self-examine their challenges and concentrate attention on their refinement. Similarly, this may help build greater understanding between stakeholders around what are the different needs on these more challenging practices.

Box 8.1. Creating a culture of professional learning

Teaching demands ongoing reflection and effort for its refinement. Several participants in the Schools+ Network have worked to foster a more open culture of learning among the teachers and school leaders in their own networks of schools. For instance, fostering opportunities for teachers to research into their own practice:

- **Facilitating systematic research opportunities:** As part of their new Digital Education Action Plan 2021-2027, the Slovenian Ministry of Education has established a consortium of schools, university researchers, and external technology partners to facilitate collaborative research projects. Projects focus on jointly developing, piloting and evaluating new didactic approaches in schools. Schools are active participants working closely with universities to co-design research questions and analyses the results. For instance, teachers have worked with university researchers to develop strategies for using digital technologies in the classroom, with key findings then integrated into pedagogical guidelines and teaching materials. The Ministry plays a key role in building partnerships and supporting funding, as well as facilitating the incorporation of research findings into curricula, professional learning and strategic orientations. Indeed, ensuring that research findings have an impact beyond individual schools is a key feature of the initiative. To this end, a range of channels have been put in place for dissemination and peer learning, with projects and their findings being shared through the Slovenian Educational Network platform, annual professional conferences, and a forthcoming journal of innovative pedagogy. Currently, 11 projects are underway, involving a total of 150 kindergartens, primary and secondary schools.
- **Fostering a collective culture of inquiry into teaching:** At the heart of the International Baccalaureate's (IB) approach to teaching is inquiry, and this also translates into a culture of inquiry among practitioners. To support teachers to think openly and critically about their practice, the IB both encourages and requires action research at the school level, in the form of a programme development plan (PDP). The flexible and participatory nature of action research allows educators to explore and implement new strategies and empowers teachers as practitioners through systematic inquiry that pertains to their local context. Designed to promote school agency, PDPs may see teachers dedicate between one to multiple hours a week depending on the scope and scale of their focus, working at an individual or collective level. Some examples of topics of inquiry include building professional capital or ensuring inclusion in the school. PDPs also serve as opportunities for learning and exchange, with the school leadership and colleagues within and outside of school – including from the IB staff body too – engaging in the evaluation process of PDPs. Wider dissemination of teacher-led learning and knowledge- building occurs through the IB's organisation of peer-to-peer virtual learning opportunities, regional school associations and wider networks.

Participants have also focused on developing broader structures for professional exchange, learning and collaboration:

- **Encouraging open reflection between practitioners:** Teach For All has sought to foster greater openness towards learning through the sharing of success stories and respective struggles between national and global peers through their Global Learning Lab. In particular, their Learning Loops focus on a cycle of observation, reflection, and action to fuel both individual and collective learning. With the evolution of the Global Learning Lab into the Global Institute for Shaping a Better Future, the idea of collective learning, points to the potential of a more open culture of cross-border learning to have externalities; the reflections of one individual, including the sharing of ongoing challenges or shortcomings, may be beneficial for

the collective awareness of colleagues. Similarly, Teach For All's thematic Communities of Practice use strategies such as in-person convenings, virtual lightning talks and instant messaging groups to enable cross-border learning between systems and classroom leaders on school leadership, EdTech adoption, and teaching practices, among others.

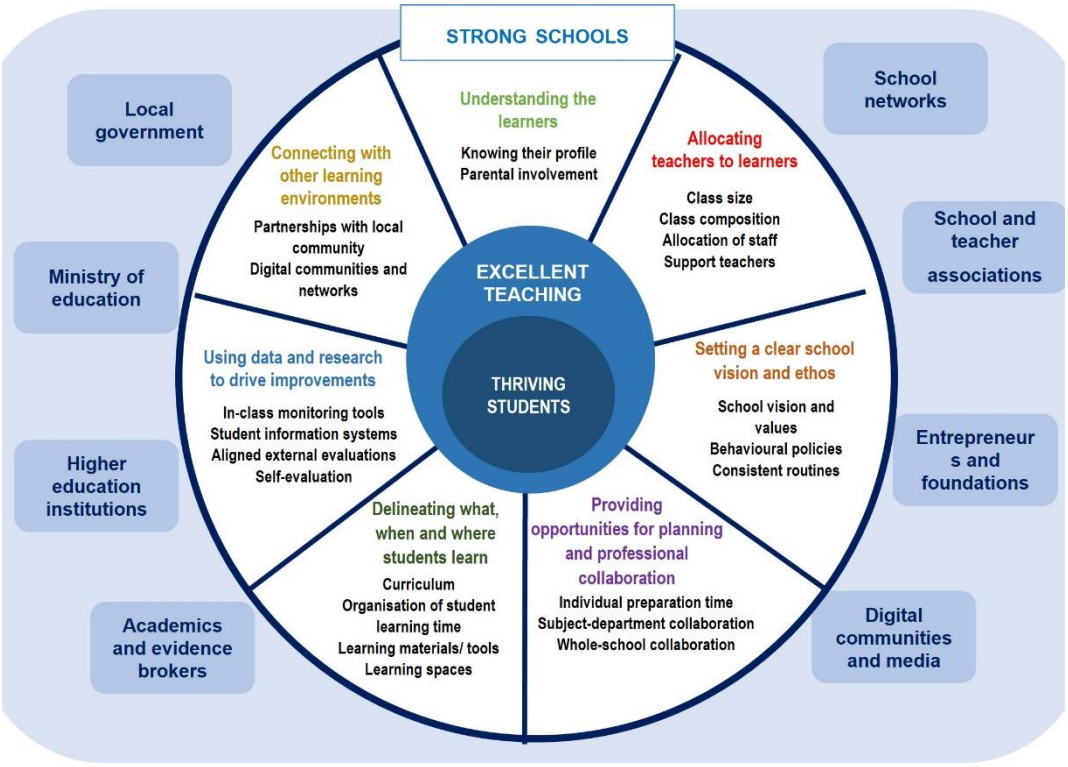
- **Opening up the classroom to others:** The European Commission's eTwinning initiative is a community for schools. Hosted on the European School Education Platform, it provides a safe online space for teachers and school staff to collaborate and develop national and international projects, as well as following peer learning and professional development activities. In particular, collaboration is characterised by a culture of open, low-stakes reflection among collaborating teachers on their joint activities, to help share expertise and improve. In 2024, the platform had 300 000 teachers registered and some 11 000 projects from 46 countries. Furthermore, a series of annual awards recognise projects that provide particularly inspiring examples of collaboration in the pursuit of rich learning opportunities.

Note: Input was provided directly from Schools+ participants.
Source: European Commission (2024[27]), *Learn from the 2024 eTwinning European prize winners*, https://school-education.ec.europa.eu/en/discover/news/learn-2024-etwinning-european-prize-winners (access on 27 January 2025)

How schools can provide a more supportive environment

School leaders play a key role in shaping policies and practices that enhance teaching quality, ensuring consistent delivery across every classroom, every day. Every teaching practice is influenced to some extent by the environment, and documenting each of these influences across the external factors is impractical with such variability. The examples below can help illustrate how school level policies might facilitate or hinder their enactment in the classroom.

Figure 8.1. Features of a supportive school environment



Understanding the learners

The ultimate goal of impactful instructional leadership is to support high-quality teaching in every lesson, every day. This is a goal motivated by students, and their needs. These needs can be very variable and stretch well beyond the control of schools and their leaders and teachers. But understanding these different needs well can be an important step to ensuring that they are properly accommodated into how instructional leadership is provided.

The **profile of learners** plays a considerable role in shaping the implementation of practices. Students differ in numerous ways that are essential to learning: their prior knowledge, abilities, conceptions of learning, learning styles and strategies, interests, motivation, self-efficacy beliefs, and emotions, as well as socio-environmental factors like linguistic, cultural, and social backgrounds. However, the greater the differences among students, the richer the opportunities for peer learning, though it also becomes more difficult to teach them effectively as a group.

Parental involvement plays a crucial role in shaping students' development, in particular that of young children and their cognitive and social skills. Accordingly, student success can be highly shaped by their family and background experiences and the sources of learning these have provided. It is, in essence, not just a question of what the school provides. The extent to which schools have in place strong parental engagement strategies – grounded in a good understanding of the ecosystem that surrounds the school and the relevant needs of parents and the community – can help ensure that teaching aligns to the influences and expectations from home, and vice versa. These can help bridge the fragmented worlds and experiences of students in and outside of school. Moreover, it may help build consistency between students' school and home lives, which may reinforce their learning and skill development (e.g. actively practising social-emotional skills).

Allocating teachers to learners

It has long been established that a key feature of instructional leadership in schools is how learning time is organised (Hallinger and Murphy, 1985[28]; Hallinger, Wang and Chen, 2013[29]). This is a broad and complex demand on leaders. One facet demands consideration of the different human elements.

The **class size** has a considerable impact on practices which are logistically intensive, for instance student collaboration or whole-class discussion. The same can be seen for a practice like building teacher-student relationships, where time with students is important for the development of these relationships.

A second, connected consideration is the **composition of the class** and how different learner profiles are organised. For instance, the diversity of prior knowledge in the classroom plays a large role in shaping how a teacher ensures appropriate levels of challenge across a range of students. Similarly, it may influence the pacing of lessons and the time invested in ensuring clarity, accuracy and coherence, or how teachers approach crafting explanations and expositions. At the same time, the ability to exchange different ideas may be significant in shaping how practices like whole-class discussion or a practice like working with multiple approaches and representations unfolds. The composition may be a particularly significant question for school leaders as they approach the integration of new teachers into the school, and the types of practices that they want them to successfully master initially.

One further consideration is **how staff are assigned** to certain classes. Schools may make decisions around whether or not there is continuity between certain classes and certain teachers. For instance, schools may choose to assign teachers the same class, or to assign students to a new teacher or teachers periodically. This decision point impacts how teacher-student relationships develop, due to how assignment shapes teachers' knowledge of students as individuals. This type of knowledge also matters for practices that help to make learning relevant to students, such as meaningful context and real-world connections, or the communication of learning goals.

A final consideration is whether teachers can get specific support from **teaching aids** for some specific or all lessons. This may take the form of a second teacher in the classroom or temporary support sessions for students in need of targeted assistance. For instance, the former may inform how a practice such as adapting to student thinking unfolds, while the latter may be significant for practices such as metacognition.

Delineating what, when and where students learn

Attention to the organisation of learning time also demands particular attention to curricula and their coordination across a school (Leithwood, Harris and Hopkins, 2008[30]), as well as attention to the more literal teaching and learning conditions (Day et al., 2010[31]).

The coverage and degree of prescription in the **curriculum** shapes what practices the teacher can draw upon; from an extreme where it determines what is covered on a lesson-by-lesson basis to another extreme where teachers have agency in determining the learning goals that a teacher derives for a lesson or how learning is sequenced over time for clarity, accuracy and coherence. Notably, some practices may or may not be part of the curriculum such as explicitly teach social-emotional skills or metacognition. Indeed, these are two pertinent examples, as they also highlight how practices may be shaped by the adoption – by a system or a school – of a specific programme in certain areas, which may mean there are distinct resources on say social-emotional learning that teachers are expected to use in their lessons.

The **organisation of student learning time**, such as the length of lessons, or how they are organised (e.g. back-to-back lessons, spaced out) can play a significant role in shaping practices. For example, practices such as facilitating first-hand experiences or working with multiple approaches and representations that may be more time intensive could be significantly impacted by the availability of time for certain experiences. Similarly, practices that are related to high cognitive effort, such as appropriate levels of challenge, or that relate to socio-emotional aspects (student-student or teacher-student

relationships, and explicitly teaching and actively practising social-emotional skills) might be influenced by students' levels of anxiety, attention and fatigue under an overloaded timetable.

A further consideration is that of the 'raw' physical materials that shape learning. For instance, **learning materials and tools**. Teachers may or may not have recourse to certain resources that influence practices. These may take a digital form. For instance, when a teacher aims to craft explanations and expositions of a topic which are clear and accessible to students, or to model working with multiple approaches and representations, the teacher may find that different types of instructional software are significant. This may also be the case for physical resources, such as those that facilitate a demonstration, or resources for formative assessment like mini-whiteboards for diagnosing student learning or feedback.

Connected to this idea of the raw materials that teachers have access to is that of **learning spaces**. Classroom spaces shape how certain practices unfold, interacting with the class size and what the physical space does or does not afford. This can be seen as particularly relevant in terms of classroom interaction, where the nature of the physical space may inform how student collaboration or whole-class discussion unfold, as well as the transitions between them. It is worth noting this type of physical space and how it can be used is significant for how a teacher may or may not be able to facilitate the building of student-student relationships too. Again, this may also be a digital consideration, with certain online learning spaces have manifestations for certain practices such as crafting explanations and expositions – which may see students independently learning or revisiting certain content in advance of a whole-class discussion in an online space.

Box 8.2. Navigating the complexity of teaching in low-resource contexts

All school and system contexts shape the teaching in classrooms in some form. Some of the networks in Schools+ work in particularly challenging low-resource contexts. Schools may face challenges such as a lack of basic resources (e.g., electricity, adequate safe space, books), limited teacher professional development opportunities, and cultural and social barriers to school engagement among their community. Networks have been developing innovative initiatives to respond to these challenges, including the following:

- VVOB has co-created with the Ministry of Education in Zambia, as well as partners like Teaching at the Right Level (TaRL) Africa and UNICEF (the United Nations agency for children), the 'Catch Up' programme. This focuses on grouping learners based on learning needs rather than age or grade to allow for more targeted teaching. To support the latter, considerable emphasis is placed on ongoing support through mentoring and coaching focus on teachers' ability to use adaptive teaching techniques. There is also a focus on using low-cost materials that can be powerful teacher aids, such as flashcards and posters, that can be combined with engaging activities such as songs, games or group challenges. Since its pilot in 2016 the 'Catch Up' programme has scaled across Zambia and shown measurable improvements in literacy and numeracy, with detectable changes in teachers' practice too.
- Global School Leaders has partnered with organisations in Sierra Leone to pilot ways of strengthening foundational literacy and numeracy through supportive school leadership. In many low-resource contexts, children's development of foundational literacy and numeracy (FLN) is impacted by a lack of access to consistent, quality instruction and learning materials, as well as potential disruption to their regular schooling. Moreover, there are limited opportunities for teacher professional learning to remedy this gap in FLN. Structured pedagogy, in which teachers get clear, step-by-step guidance to effectively teach foundational literacy and numeracy, offers a promising solution to bridge these gaps and empower teachers.

Global School Leaders is exploring how to strengthen structured pedagogy in classrooms by equipping school leaders with the knowledge and skills to support teachers. This includes developing leaders' own pedagogical knowledge base and providing them with coaching on how to observe and give feedback to teachers, and how to facilitate groups of teachers analysing and discussing FLN assessments together.

Note: Input was provided directly from Schools+ participants.
Source: De Barros et al., (2023[32]), *A randomized evaluation of the Catch Up Program in Zambia: Baseline Report*, https://www.gpekix.org/knowledge-repository/randomized-evaluation-catch-program-zambia-baseline-report; Triphati et al., (2021[33]), *Mid-line Evaluation of Catch Up scale up programme in Zambia: Final Evaluation Report*.

Providing opportunities for planning and professional collaboration

Building strong relationships within a school's teaching staff may be one important manifestation of high-quality instructional leadership (Day et al., 2010[31]). This also hinges upon wider leadership activities such as the important questions of how teachers' reflection and professional growth opportunities are provided for (Hallinger and Murphy, 1985[28]; Rodrigues and Ávila de Lima, 2021[3]; Blase and Blase, 2000[34]), as well as the degree of trust that leaders place in teachers to direct a high-quality teaching and learning agenda in the school (Day et al., 2010[31]).

The **individual preparation time** for teachers to plan lessons and learning opportunities plays an important role. This time is a space for thinking hard and reflecting about what practices might be more effective for a specific class. This can be significant for determining the immediate learning opportunities of lessons, being of particular relevance, for example, for practices that hinge upon students' prior learning, such as having time to ensure the levels of challenge are appropriate to the students at hand or that students are ready for making certain connections between the subject-matter. It is also particularly pertinent for considering the wider sequencing of learning opportunities and ensuring clarity, accuracy and coherence. It is also significant for not only shaping the learning opportunities but also how they are monitored; time to reflect and plan in advance may also be significant for a practice such as diagnosing student learning so teachers can strategically consider where they may need to engage in more formal formative assessment opportunities.

Another manifestation of preparation time may be that with colleagues, such as **subject-department collaboration**. For instance, practices like meaningful context and real-world connections or nature of the subject may be time intensive, demanding that teachers undertake a degree of research for the most relevant resources or examples to use, or be enriched by the ability to exchange ideas with other subject experts like their colleagues. The ability across a department to exchange and adapt one another's learning materials and ideas may be a significant enabler of these practices happening.

The same may also be true for a further manifestation of preparation, that of **whole-school collaboration**. If there is alignment across subjects on a certain topic, they may be able to mutually reinforce each other in their lesson planning, such as through the use of aligned summaries or plenaries leading to more clarity, accuracy and coherence. It may also mean the implementation of first-hand experiences that are inter-disciplinary. School leaders may organise and take responsibility for the success of such peer-learning and collaboration sessions.

Setting a clear school vision and ethos

The values and ethos that pervade a school are difficult to concretely capture but have an important impact on the interactions that occur across the school on a daily basis, be it those interactions between students or those among teachers and leaders. A key feature of instructional leadership and the work of school

leaders is defining and building this vision and ethos that will permeate the school (Day et al., 2010[31]; Leithwood, Harris and Hopkins, 2008[30]).

The **school vision and values** shape how teachers implement practices. Some schools might even have a specific pedagogic vision and ethos that drives the recruitment of teachers on the basis of their adherence to a specific pedagogical approach. Regardless of the adherence to a specific pedagogical approach, the school values and ethos tend to permeate into concrete norms and expectations that guide the interactions of the entire school community. This type of norm-building can shape the form of practices across classrooms, such as how teachers nurture a supportive classroom climate or how students view the teachers' diagnosis of student learning as a positively good thing for their progress and not an evaluation. For instance, a classroom climate may promote mistakes as learning opportunities, but this could also be a wider, whole-school approach about experimentation and the value of failures which reinforces this messaging to students.

Some practices can be highly dependent on routines around transitions or positive behaviours, such as student collaboration or first-hand experiences. Whilst these are shaped by the individual classroom and the teacher's individual classroom management, the wider school's policies and approaches to classroom management, or the so-called **behavioural policy**, are also significant. For instance, an inconsistent approach among teachers to disrespectful behaviour between students when collaborating may send students signals that sometimes or in some settings such behaviour is acceptable.

A further manifestation of **consistency and routinisations** may be in relation to how certain practices are embedded to reduce their cognitive burden and workload, on both students and teachers. School leaders and teachers may oversee the establishment and refinement of approaches towards certain practices that can work consistently effectively across classrooms. For instance, consistent language in practices such as questioning or whole-class discussion may mean certain behaviours become embedded at a school level. Students may, for example, become habituated to justifying their answers with evidence. Also, practices such as metacognition and feedback may be approached through the same cross-classroom approaches, such as routines for how self-reflection unfolds or how students respond to feedback.

Box 8.3. Empowering school leaders to be leaders of high-quality teaching

School leadership can have a significant effect on features of the school organisation which positively influences the quality of teaching and learning (Day et al., 2019[35]). At the same time, the demands and pressures on school leaders are considerable. School leadership can be a lonely and challenging role. Networking opportunities can allow for co-construction of knowledge as well as providing support that better fits the actual needs of a school. The OECD's Teaching and Learning International Survey (OECD, 2019[36]) found that 61% of principals reported "participation in a network formed specifically for their professional development".

Some countries have sought to tap into the power of networks through associations of school leaders. One notable example comes from Ireland, where the Irish Primary Schools Principals Network (IPPN) is a professional association representing over 1000 leaders – accounting for 98% of primary school leaders in the country. It provides a significant platform for professional collaboration and advocacy and has played an instrumental role in the professionalisation of school leadership through different initiatives including establishing a leadership centre. It has also undertaken substantial research into the profession, for instance through its 'Sustainable Leadership Project' which has surveyed leaders and undertaken extensive document analysis to provide insights on the nature of leaders' work. This has served as a platform for developing recommendations and tools, such as the IPPN's Leadership Effectiveness Reflection Tool.

Looking beyond borders can also be powerful.

- The European School Heads Association (ESHA) is an international community of 38 member organisations in 27 European countries, representing some 120,000 school leaders. On the one hand, it seeks to both foster the exchange of experiences, knowledge and visions and support the recognition and professional development of school leaders. ESHA develops a series of resources as well as facilitating the opportunity for leaders to participate in international networks and be hosted by another leader in another country to shadow their work and collaborate on common school leadership themes. The community is also a place that encourages new ideas to develop. The latter is exemplified in ESHA's participation in several different research projects co-funded by the Erasmus+ programme and Horizon of the European Union, with projects ranging from open schooling, sustainability education, parental engagement to digitalisation.
- The International Confederation of Principals is a global network of some 35 national and regional school leader associations from across four regions of the world, as well as individual members and partners in the area of school leadership. It is dedicated to the development, support and promotion of school leadership, with a particular focus on sustainable leadership and how leadership challenges and good practices are not limited by national boundaries. Each member of the network is a major organisation that supports the professional development and work of school leaders. The network is a means of sharing ideas, innovations and best practice, but also of fostering friendship and support recognizing the high-pressure challenges leaders face on a daily scale.

Using data and research to drive improvements

Enabling a formative environment orientated around data can be a powerful support from school leaders for their teachers (Day, Gu and Sammons, 2016[37]). In particular, a core feature of this is monitoring student progress and using this to constructively inform the teaching and learning programme in the school (Leithwood, Harris and Hopkins, 2008[30]).

There may be the availability of **in-class monitoring and assessment tools** that facilitate the monitoring of student progress and how it is used formatively to drive learning. For instance, certain digital tools, including those based on artificial intelligence, may play a role in shaping how teachers diagnose student learning and provide feedback. They may also be tools for students; for example, facilitating the revision of certain content and 'weak points' to ensure clarity, accuracy and coherence in student knowledge, or how students digitally map their learning and make connections. Notably, these tools may stretch beyond purely cognitive outcomes and knowledge acquisition; it may be that tools also facilitate student self-assessment and their ability to log their own progress, including their social-emotional skills acquisition, to enable metacognition to be practised over time. It is worth noting that such tools may have financial considerations for schools too.

At the school-level, the provision of **student information systems**, as well as developing teachers' fluency in using them, can help the overall staff body to have access to key information about students to impactfully inform their decision-making in the classroom. For instance, it may inform a more intensive period of attention to strengthen the teacher-student relationship or to the levels of adapting to student learning, with a teacher perhaps prioritising more supports and scaffolds to a student, or more extensions too.

The **external evaluations context** runs throughout classrooms and schools in a system shaping the day-to-day teaching that unfolds. Assessment is a critical component of the teaching-learning process which informs the effectiveness of instruction. The alignment between external evaluations to the way that students are assessed in schools, including in terms of what is assessed and the level of attention it is

given, can help inform teaching and learning in classrooms, and in the contrary distract from it. For instance, practices such as explicitly teaching and actively practising social-emotional skills may see less attention in an assessment system that gives little consideration to the wider holistic development of students.

Finally, schools may also seek to foster strong **self-evaluation processes** across the school that are orientated around learning and refining through data. This may seek to foster synergies between formal summative assessments, in-class formative assessment, and teachers' own professional learning and evaluation. An open culture that allows for the honest identification and examination of the areas of practice for further refinement – be that as an individual teacher or as a collective of teachers in a school, or with the support of external system leaders too – coupled with mechanisms of support for realising this refinement, may impact how practices unfold. This type of orientation towards growth might facilitate more risk-taking with practices that invite greater teacher exposure, say student collaboration, which can see more student agency at the expense of teacher control.

Connecting with other learning environments

Identifying and facilitating opportunities for external collaboration and building strong relationships outside the school community may also be mechanisms that school leaders draw upon as part of their instructional leadership in the school to support the impact of teaching and learning (Day, Gu and Sammons, 2016[37]; Day et al., 2010[31]).

The **local community** may serve as an enabler for certain practices. Classroom and schools may have connections to the local, or wider, community that may furnish them with resources or opportunities to support the implementation of certain practices. For instance, this may be particularly significant in terms of how first-hand experiences unfold. Partnerships with community actors may facilitate authentic inquiry projects that are relevant to students. Indeed, the community can have a particularly large influence on how meaningful context and real-world connections are implemented in classrooms.

Connections can also broaden horizons and enable a deeper understanding of the possibilities that exist. **Digital communities and networks** can also play a notable role in potentially shaping the above practices, just like the local community. Through the connections they facilitate, they may also be significant for shaping how teachers create opportunities to explicitly teach and actively practise social-emotional skills with students, for example skills such as open-mindedness. More broadly, these communities and networks may serve as reflective learning opportunities for practices where professional knowledge is exchanged and augmented.

Box 8.4. Reflecting on leadership practices

School leaders may consider the following reflective questions, suggested by the schools of the Schools+ Learning Circle, in navigating these contextual factors.

Understanding the leaners

- What activities at the beginning and throughout the school year might be most helpful to support teachers in understanding their learners in a multi-dimensional way?
- How is student voice used by teachers to refine their practice?
- What differentiated strategies are used for the hardest-to-reach parents and how does this inform teachers' work with students?

Allocating teachers to learners

- How does the school respond to the challenges that large class sizes present for certain practices?
- What type of support and resources are provided to help teachers with managing diverse learning needs within a class in an impactful way?
- What specific activities do teachers use to build quality relationships with their students, even when faced with time constraints or numerous students to attend to?

Delineating what, when and where students learn.

- How are learning spaces organised to support teachers to use certain practices that present considerable logistical demands (e.g., student collaboration, building-relationships, first-hand experiences etc.)?
- How are teachers supported in the selection or design of instructional materials and tools for lessons?
- How are the school day and lessons, as well as wider school weeks, structured to impactfully support student learning and respond to student needs?

Providing opportunities for planning and professional collaboration

- What structures help to enable quality planning, both individually and in collaboration with colleagues?
- What methods could foster collaborative reflection and inquiry among teachers to improve their practices?
- What specific in-school initiatives could ensure teachers and leaders engage in professional learning opportunities despite heavy workloads?

Setting a clear school vision and ethos

- How are staff and students, as well as the wider school community, engaged around a common, clear vision for teaching and learning in the school?
- What strategies are employed at the school level to ensure high standards of behaviour and respect among students, and consistency among staff in actively using these strategies?
- How are certain routines developed across the school to support the effective implementation of practices, whilst remaining sensitive to different classroom needs?

Using data and research to drive improvements

- What types of tools or supports are available in the classroom for teachers to use to make timely adjustments to their teaching in line with student progress?
- What is the approach across the school to monitoring progress and supporting teachers and leaders in using this data to make decisions?
- How are teachers and leaders supported to stay up-to-date with the latest developments in research, and to critically engage with these?

Connecting with other learning environments

- How are teachers able to draw upon the local community to support their implementation of different practices for richer student learning opportunities?
- What connections exist with other networks or stakeholders to positively support teachers' professional learning?
- How are digital communities drawn upon to enrich student learning opportunities or the professional learning opportunities of teachers?

Towards high-quality teaching

Efforts to improve teaching quality often focus on more visible, surface-level factors within schools that are relatively easy to change. It is altogether simpler, if expensive, to reduce class size or raise the numbers of computers in schools than it is, for instance, to sustainably improve teachers' capacities to respond to individual student differences.

It is far harder to reshape the core activities and dynamics of learning in the classroom, especially as doing so requires a deep understanding of what quality teaching entails in daily practice (Bereiter, 2002[38]; Fullan, 2006[39]). This report has sought to advance that understanding with the consideration of 20 practices. It has both looked inwards at the granular intricacies of implementation for each practice, as well as outwards from these practices to the wider school environment that can influence implementation.

Successful changes thus need a deeper consideration of how to support teachers improve their skill and create a supportive environment. For example, the recent emphasis on practices that demand greater individualisation such as explicitly teaching and actively practising social-emotional skills is likely to be particularly challenging for teachers given that this is a new demand for which they haven't been prepared, and may be disproportionately challenging if their class is very culturally diverse. Similarly, new opportunities to build greater student agency, such as through collaboration or first-hand experiences, are only likely to be effective to the extent that sufficient school resources and ongoing support for teachers' skill development are in place (See Box 8.5). What expectations of success should be placed on schools and their professionals if the complexity of change is not considered?

Box 8.5. Taking into consideration the complexity of changing teaching in Billund, Denmark

In Billund, Denmark, the local government set out to develop a clear, coherent vision for what the local schooling experience should be like for young people. This vision was shaped through a series of design thinking workshops that included children, actively involving them in designing their new learning environments. The implementation of this vision required providing children with learning experiences that are more interactive, engaging, meaningful, and joyful; and thus, required a thorough reevaluation of teaching methods and reconfiguring school policies, practices and physical spaces.Implementation in schools began in 2019 with a pilot in Vorbasse Primary School, who adopted the new approach with two grades of students. Over the subsequent two years, this was then implemented across all remaining grades in the school building on the evolving insights that the pilot yielded. From this pilot, the approach has expanded to Billund's five other primary schools in a staggered way. Several key features of this process included:

- Adapting to school preferences on when and how to adopt and implement changes. For instance, some schools implemented playful learning reforms with just some grades, and others across the whole school. In this respect schools retained agency over their development.
- A clear communication plan, including for parents and guardians, outlined the goals of the changes and their rationale. This communication effort also included direct experiences of the type of learning students were envisaged to engage in. This was designed to ensure that there was shared understanding and buy-in from the community around schools.
- Ongoing and adaptive support through four school consultants and professional networks for sharing knowledge and experience, and building a support community as the reforms demanded many teachers adopt wholly new practices. This also included dedicated workshops focused on particular tools, team meetings and discussions, and observation and feedback on teaching.

The initiative has been deemed successful by the Billund Municipality, with qualitative evaluations indicating positive reception from both students and teachers. It also builds into Billund's aim to transform the city into the 'capital of children', supported by a wide array of local stakeholders, including the LEGO Foundation.

Source: Billund Municipality (2024[40]), *What is Playful Learning?*, presented by the Billund Municipality at the Schools+ Third Global Community Meeting 30th April 2024, https://www.billund.dk/borger/pasning-og-skoler/skole/at-laere-gennem-leg-playful-learning/ (accessed on 30 April 2024).

This report highlights that high-quality teaching does not occur in a vacuum. It is not solely the result of excellent teachers but also requires excellent schools. Improving the quality of teaching goes beyond only helping teachers refine their practice, but also involves creating a supportive environment where teachers can thrive. This is not surprising; yet we still know little about each of the two, and their interplay. What happens in classrooms and in schools is often hard to see, with the final student outcomes being what garners most attention. However, only through a deeper understanding of the processes and mechanisms behind teaching and learning can improvements be made.

A better understanding of the complexity of teaching demands engaging with the professionals in our schools. Naturally, teachers play a key role in leading on their learning as reflective professionals, but so too school leaders in creating an environment where teachers can grow their practice. This goes to the heart of our education systems and the need to better recognise and leverage the expertise of our schools. In a time of rapid change, building a stronger profession is critical, as the central role of teaching in shaping young people and their future lives is likely to only remain constant.

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Annex A. Methodology

This annex presents the methodological approach followed in this report carried out under the OECD Schools+ Network initiative. By placing schools at the centre, this initiative seeks to draw insights from the frontline of our educational systems to improve education policy and practice, and provide a space to build bridges across policy, practice, and research. The methodology is one that, reflecting the objective to build bridges, has been characterised by a multi-stakeholder, collaborative and iterative development.

The aim and goals

The overall aim of the work has been to to advance the understanding of school-level practices. To this end, the work has focused on three concrete goals:

- **Goal 1:** Develop a taxonomy of teaching that cuts across different pedagogies and provides shared language to facilitate a multi-stakeholder dialogue and knowledge exchange.
- **Goal 2:** Identify the best research evidence available for the practices included in the taxonomy and provide an indication of the respective areas of strength and limitation.
- **Goal 3:** Leverage the professional knowledge of schools on the implementation of the practices included in the taxonomy to further understand their complexity.

The main activities and data collected

The Schools+ Network collected a range of different data to achieve these goals. These included the following activities:

- Meetings of the Informal Expert Group to develop background documents on the taxonomy of teaching
- Rating exercise with experts and organisations on the strength of evidence of practices, supported by qualitative insights on specific strengths and limitations
- Online surveys and meetings with schools to derive qualitative insights on challenges and approaches to implementing teaching practices
- Rating exercise with schools on the complexity of different teaching practices
- Consultation with experts, organisations and schools on the terminology and conceptualisation of teaching practices.

The following types of data were collected:

- School questionnaire on their background, practices and attitudes towards research and teaching practices
- School questionnaire on the terminology used to refer to practice and open qualitative comments on background documents
- School questionnaire on teaching decisions and signals from students

- Expert ratings on the strength of the best evidence available from evidence brokerage organisations and academics, supported by open questions on specific strengths and limitations
- Targeted comments on specific areas of the chapter and opportunities to openly review them from schools
- Expert ratings on the complexity of practices from schools
- Open case study submission and peer review from schools.

Participation

As mentioned, the work of Schools+ has depended upon the contributions of a range of different stakeholders. The Schools+ Network consists of two broad groups: Network participants and participating schools.

Schools+ Network participants

Since its launch on 22-23 May 2023, the Schools+ Network has grown to include over 50 participating institutions, such as ministries of education, local authorities, teacher and school leader organisations, large school networks, evidence brokerage organisations, and entities supporting educational development like philanthropic foundations and international organisations (see Table A A.1 for a complete list). Participants are invited to participate in two Global Community meetings annually, held in-person and virtually, to provide feedback on ongoing work.

Table A A.1. List of participants in the Schools+ Network

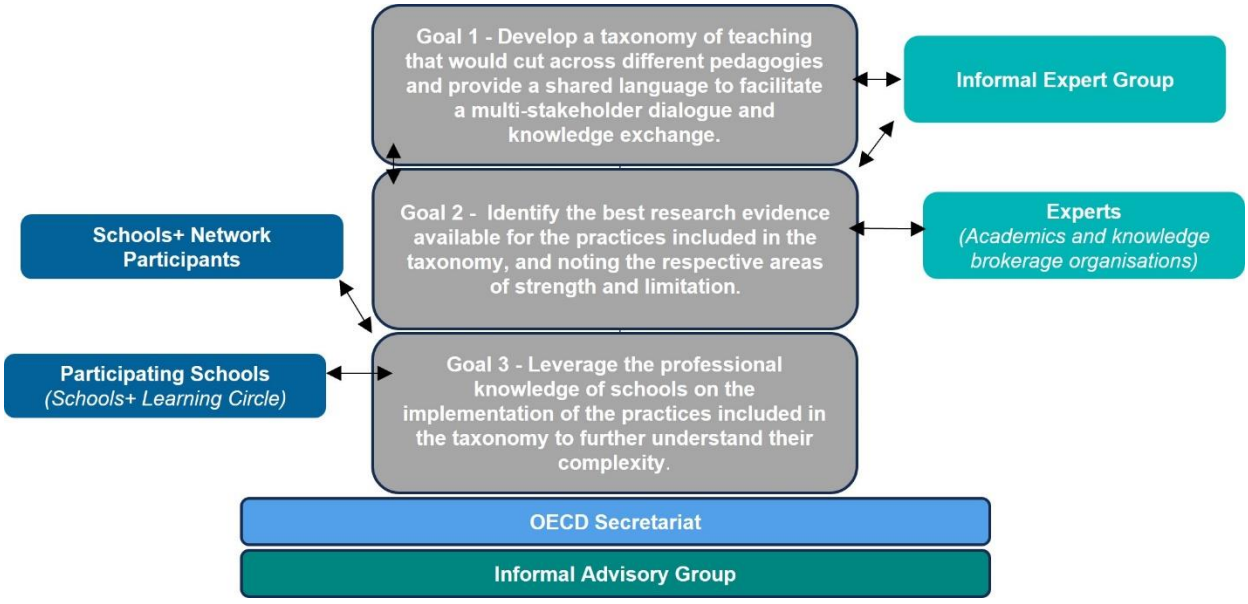
OECD countries	Non-OECD countries
Belgium	Bulgaria
Colombia	Croatia
Finland	People's Republic of China
France	Romania
Italy	South Africa
Latvia	
Lithuania	
Luxembourg	
Norway	
Portugal	
Scotland (United Kingdom)	
Slovak Republic	
Slovenia	
Sweden	
Switzerland	
Türkiye	
Organisations	
Aga Khan Foundation (Schools 2030)	LEGO Foundation
Council of British International Schools	Magis Qualis
Creative Schools Program	Networks of Inquiry and Indigenous Education
Digital Promise	OBESSU
Education International	Osvitoria, Ukraine
Edutopia, George Lucas Educational Foundation	Research Schools Network and Education Endowment Foundation
European School Heads Association	Results for Development (SALEX)

European Schoolnet	SUMMA (Laboratory of Education Research and Innovation for Latin America and the Caribbean)
Eutopía	T4 Education
Red de Escuelas Líderes — Fundación Minera Escondida, Fundación Educacional Arauco, Fundación Educacional Oportunidad, Fundación Chile, El Mercurio	Teach for All
Global School Leaders	Transcend Education
Global Schools Forum	UNESCO
HundrED	Varkey Foundation
International Baccalaureate	VVOB
International Confederation of Principals	World Federation of Associations of Teacher Education
Jacobs Foundation	
Keller Education	

Participating schools

To better capture schools' practices and expertise, participants in the Schools+ Network nominated schools to join the 'Learning Circle'. Schools were nominated based on their experience with research evidence and their interest in innovation. Over 150 schools from 40 countries, representing around 140 000 students, convened quarterly to further enhance our understanding of teaching practices. More information on the composition of schools can be seen below (see Figure A A.1). Schools were not designed to be a representative sample, and this should be considered when interpreting insights from schools.

Figure A A.1. Overview of participation



The work of the Network has also been supported by two informal groups. First, the Informal Advisory Group. This group has provided ongoing support on coordination aspects of the Network with representatives from two OECD member countries (France and Portugal), five global and regional organisations (Education International, European School Head's Association, International Conference of Principals, SUMMA, and UNESCO), and two philanthropic organisations (Jacobs Foundation and the LEGO Foundation).

Second, the Informal Expert Group. Consisting of academics from different institutions, this group has supported the development of the Pedagogical Taxonomy, reviewed the current research evidence, and provided advice on the expertise to be sought from schools (see Table B.3 in Annex B).

The Network has also relied on the contributions of numerous experts who have taken part in consultations. Table B.5 in Annex B provides a list of the 26 experts from academia and knowledge brokerage organisations that contributed to the rating exercise and review of scientific evidence on practices. Additionally, a wider group of academics and organisations also contributed qualitative input on the conceptualisation of practices and the scoping of their evidence base (see Table B.5 in Annex B).

Goal 1. Developing a taxonomy of teaching practices

The Schools+ Taxonomy of Teaching is the backbone of the work on advancing the understanding of teaching practices. It provides a "shared language", a framework for educators, researchers, and policymakers to discuss and better understand classroom practices.

An iterative, inclusive, and participatory approach to the development of the Taxonomy was considered paramount to ensure its terminology and descriptions were appropriate and shared across different stakeholders. The main milestones are noted below.

Defining the design features, structure and key practices of the Taxonomy (November 2022 – March 2023)

Together with the OECD Secretariat, the Informal Expert Group (see Annex B) developed a preliminary version of the Taxonomy. A major reference was the OECD's Global Teaching InSights Observation System which was developed for a pioneering Video Study that drew upon multiple methods to observe and document teaching in a detailed way, whilst also investigating which aspects of teaching are related to student learning and student non-cognitive outcomes.

The Global Teaching InSights Observation System was developed through four cycles of extensive cross-country collaboration between observation and pedagogical experts between 2015 and 2020. This observation system undertook the challenge of designing measures of teaching practices that would be applicable, valid and comparable across countries and across a variety of cultural contexts. To achieve this, the development drew upon four importance sources: participating countries'/economies' conceptualisations of teaching quality, a review of relevant international research literature on the topic, and the conceptual frameworks of both the OECD's Teaching and Learning International Survey (TALIS) and the Programme for International Student Assessment (PISA).

The initial phase of work on the Schools+ Taxonomy focused on scoping which practices could be carried forward from that reference framework and which other frameworks should be examined in more detail. It resulted in the identification of five major goals of high-quality teaching and an initial list of potential practices to be further investigated. Table A A.2 presents a summary of the differences between the Schools+ Taxonomy and Global Teaching InSights Video Study Observation System.

Table A A.2. Differences between the Schools+ Taxonomy and GTI Video Study Observation System

Objective	Schools+ Taxonomy	GTI Video Study
Overall goal	Provide a more shared language of pedagogy to facilitate evidence-informed learning and exchange on teaching across borders.	Facilitate the standardised observation of classroom practice by observers across different contexts.
Context	Focus on practices that characterise evidence-informed teaching across a range of subjects.	Focus on mathematics classrooms, specifically the teaching of algebraic content, with a focus topic of 'quadratic equations'.
	Focus on practices that characterise evidence-informed teaching across both the primary and secondary levels.	Focus on teaching at the secondary-level, target similar age/grade levels to PISA.
Aspect of teaching	Consider the role of teacher and student behaviours in the classroom.	Focus on the observable behaviours of teachers during lessons, about which observers could make inferences without significant additional information.
	Focus on the essential practices that cut across different pedagogical frameworks and evidence bases, in a way that avoids cognitive overload and reflects the language of practitioners.	Provide a scaled rating of individual practices in a granular way.
Primary audience	Teachers and school leaders engaging in critical reflection, exchange, and learning about practice.	Observers participating in the rating of videos.
	Policymakers, knowledge brokers and researchers exchanging around teaching.	Researchers working on the observation of practice.

Developing shared definitions (November 2022 – September 2023)

Each of the broad five teaching goals of the proposed Taxonomy was assigned a lead author from the Informal Expert Group, who refined a list of practices and examined the evidence behind each practice, with particular attention to empirical studies, meta-analyses and systematic reviews. Each author also provided an initial descriptor to define each practice. The proposed practices and definitions from across the five goals were collectively further refined through both online and in-person meetings, leading to a first version of the Taxonomy. This version included 22 practices organised into the five goals, complete with definitions and associated terminologies, supported by background documents that provided the conceptual understanding for each goal.

Expert review process (September 2023 – November 2023)

The OECD invited more than 100 experts from academia and knowledge brokerage organisations to partake in an expert review process. A total of 43 leading academics in the field of pedagogy, as well as education knowledge brokerage organisations, detailed in Annex B, provided feedback on the first version of the Taxonomy. The main goals of the review were to check on the alignment of the Taxonomy to different bodies of literature and ensure the appropriateness of definitions, whilst also developing an indication of the strength of evidence for each practice. Experts provided feedback independently from each other to reduce potential bias, and experts were invited to provide feedback based on where their expertise best aligned to the Taxonomy. This feedback was aggregated by the OECD, who then organised a series of discussion meetings with different stakeholders to further support the refinement of the Taxonomy, including an in-person meeting with a group of 14 knowledge brokerage organisations on 30-31 October 2023.

A broad consultation across education stakeholders (November 2023 – January 2024)

As the Taxonomy aimed to move towards a more shared language of pedagogy, a range of different education stakeholders were invited to comment on the first version of the Taxonomy. In particular, participating countries and organisations in the Schools+ Network were invited to provide feedback as well

as over 150 schools from 40 different countries (see Annex B). The feedback sought was focused on the definitions and associated terms of the proposed core practices, as well as the conceptual background documents.

Finalisation of the Taxonomy (February 2024 – April 2024)

The consultation processes yielded valuable feedback that led to significant adjustments in the final version of the Taxonomy, such as the addition of Metacognition under Cognitive Engagement, the redefinition of Creating a Supportive Classroom Climate in the Social-Emotional Support dimension, and the relocation and merger of Crafting Explanations and Expositions with Explicit Procedures and Methods into the Quality Subject Content dimension (see Table A A.3). The feedback received also helped to provide greater precision and clarity to numerous descriptors, as well as yielding additional associated terms for each practice.

Table A A.3. Summary of substantive changes to the first version of the Taxonomy post-consultation

Theme	Substantive changes	Rationale for change
Cognitive Engagement	*Metacognition* was added as a new practice.	Suggestions to give greater prominence to ideas of metacognition and self-regulation, beyond just teaching social-emotional skills.
	Fluency and flexibility was dropped.	*Fluency and flexibility* was deemed too much of an outcome with insufficient evidence. The more well-evidenced strategies within the practice already had overlap with *Clarity, accuracy and coherence* in Quality Subject Content.
Quality Subject Content	*Crafting explanations and expositions* was moved from *Classroom interaction*, and combined with *Explicit procedures and methods.*	Suggestions indicated better conceptual alignment *with Quality subject content*, emphasising high-quality subject matter.
	Merge *Making connections* with the additional practice of *Exploring patterns and generalisations.*	The separation was very orientated towards mathematics and risked becoming repetitive. This would also better highlight the distinction with explanations.
Social-Emotional Support	*Nurturing a supportive classroom climate* was reworked to include belonging and security.	*Feedback* indicated a need to consider belonging and security, instead of focusing solely on cognitive skills.
Classroom Interaction	Include the *Responding* nature of questioning.	Concentrate attention more on the teacher questioning and reiterate the back and forth nature of questioning with student responses informing future questions.
Formative Assessment	Focus on 'diagnosing' student learning rather than eliciting student thinking.	'Diagnosis' reiterates the need to interpret student thinking and potentially probe this.

Goal 2: Identifying the best evidence available

With an initial draft of the Taxonomy developed, the OECD Secretariat conducted a consultation process with experts and commissioned an independent literature review to identify the best evidence available and existing limitations of the evidence base.

Consultation process with experts

Experts consisted of those working in academia and in knowledge brokerage efforts. A full list is provided in Annex B. Experts from academia were selected through a multi-faceted approach: (a) recommendations from the Informal Expert Group, to ensure alignment with the project's objectives; (b) from key references in the bibliographies of the background documents to include a breadth of disciplinary perspectives; and (c) nominations from participating experts to include additional scholars with valuable insights.

Objectives of the review

Experts were asked about the respective strengths and limitations of the evidence bases behind different practices included in the Taxonomy. Specifically, experts were invited to:

- Rate the strength of evidence for teaching practices using a shared set of criteria.
- Provide qualitative insights detailing the rationale behind their ratings, including any perceived limitations or strengths within the evidence base.
- Suggest key studies or ongoing debates that potentially merited inclusion.
- Share feedback on the definitions and terminologies used in the Schools+ Taxonomy to refine the conceptualisation of the practices (see Expert review process (September 2023 – November 2023) above).
- Provide qualitative insights on a set of key considerations that contribute to effective implementation in a classroom and the enabling conditions or barriers that schools may encounter when implementing certain practices effectively.
- Rate, based on their experience, how often practices were implemented in an effective, impactful manner in classrooms and to share through open text comments the challenges they felt teachers grappled with when trying to implement or refine the teaching practices. These were used to refine the key considerations that broke individual teaching practices in a more granular way.

Experts were invited to provide input only in areas of their expertise. This meant that experts could choose to provide feedback on some particular practices based on their expertise, on several or all of them. A total of 26 experts provided ratings on the strength of the evidence, though practices received a variable number of ratings. An additional 17 academics and organisations provided qualitative input on the conceptualisation of practices and the scoping of their evidence.

Experts provided their ratings independently from each other to help reduce potential bias from social conformity or from dominant individuals. Experts were given the same instructions on the process and an Excel document to conduct their ratings and share their comments through, that was then returned via email. To support consistent interpretation, experts were provided with the same definitions for each practice of the Taxonomy and the background work.

Box A A.1. Criteria for the ratings on the strength of evidence

For each of the practices in the first version of the Schools+ Taxonomy, experts were asked "How would you rate the strength of evidence?" and invited to choose one of the four following labels:

1. **Emerging:** The evidence is primarily theoretical and there is limited robust empirical evidence, or the evidence is limited to specific contexts and/or students;
2. **Promising:** The research base is developing and showing promise, but there may still be a greater reliance on theoretical rather than robust empirical studies including experimental studies, and/or a high degree of variation in studies. There may only be a limited number of contexts represented in studies;
3. **Solid:** The research base is solid with a good number of robust empirical studies including experimental studies, and a solid understanding of how effects may vary across different contexts;
4. **Strong:** The research base is strong with a large number of robust empirical studies including experimental studies, and a high degree of consensus around the mechanisms that drive outcomes and how these vary in different contexts. There are observational and cross-sectional studies that feed into the evidence base too. The total number differs across practices because experts were only invited to comment on their areas of expertise.

Definitions of the labels were developed in consultation with the Lead Expert of the Informal Expert Group. An open text box was included for each practice too that had the following instruction: "Please feel free to explain the rationale of your evidence rating or offer any suggestions you have on the strengths and limitations".

Processing experts' review

The expert feedback was consolidated into a comprehensive master file, which recorded all the ratings assigned to each practice, along with verbatim transcriptions of experts' qualitative comments. Basic statistics on their distribution and mean of ratings were calculated. The rationales accompanying the ratings were carefully reviewed, and key strengths and limitations were distilled into thematic categories.

One particular concern was ensuring consistency in the interpretation of evidence strength across reviewers. To address this, a series of steps were undertaken:

- Raw ratings of the evidence strength, aggregated ratings, and accompanying rationales were shared with the Chair of the Informal Expert Group to independently review (see Table A A.4).
- The Chair independently assigned an overall rating to each practice based on their analysis of the rating variation, the underlying rationales of ratings, and the detailed scoping of the evidence for each practice in the Informal Expert Group's background documents (see Developing shared definitions (November 2022 – September 2023)).
- To ensure the objectivity and reliability of the findings, the OECD Secretariat conducted a parallel blind review too, replicating simultaneously the same process of assigning an overall rating as the Lead Expert.
- Any disagreements were reconciled through iterative deliberations and practices were organised into three groups that would reflect the degree of consensus on the causal impact of practices.
- For additional input, initial ratings were also reviewed and discussed with the wider Informal Expert Group and participating education evidence brokerage organisations at the aforementioned

"Meeting on Linking Evidence and Practice in Education" to explore potential patterns and avenues that could be pursued.

Table A A.4. Summary of the ratings on the strength of evidence from the review process on the Taxonomy

Goals	Practices	Total	Mean rating (1 'Emerging' – 4 'Strong')	Degree of expert consensus
Classroom interaction	Collaboration	19	3.1	Medium
	Whole-class Discussion and Dialogue	19	3.2	Medium
	Questioning	16	3.6	Medium
	Explanations	14	2.2	Low
Cognitive engagement	Ensuring Good Levels of Challenge	12	2.8	Low
	Fluency and Flexibility	12	2.7	Low
	Working with Multiple Perspectives	10	3.1	Low
	Facilitating First-hand Experiences	10	2.4	Low
	Meaningful Context and Real-world Connections	13	2.1	Low
Formative Assessment and Feedback	Learning Goals	11	3.7	High
	Eliciting Student Thinking	11	3.0	Medium
	Feedback	11	3.9	High
	Aligning to Student Thinking	10	3.0	Medium
Quality of Subject Matter	Nature of the Subject	8	1.9	Low
	Making Connections	8	2.9	Low
	Exploring Patterns and Generalisations	8	2.0	Low
	Explicit Procedures and Methods	9	2.1	Low
	Clarity and Accuracy	7	3.4	Medium
Social-emotional support	Creating a Supportive Classroom Climate	18	2.7	Medium
	Relationship Building (Student-Student)	17	2.4	Low
	Relationship Building (Teacher-Student)	17	2.9	Medium
	Explicitly Teaching and Actively Practising Social-Emotional Skills	16	2.4	Low

Note: This table includes responses from the 26 academics and knowledge brokerage agencies that provided ratings on the strength of the evidence as part of their participation in the expert rating exercise.
1. It is important to note that participants did not respond on all dimensions.
2. The mean rating was calculated by assigning a 1 for each label of 'Emerging', a 2 for each label of 'Promising', a 3 for those rated 'Solid', and a 4 for those rated 'Strong'.
3. The practices and their phrasing are those from the first draft of the Schools+ Taxonomy of Teaching.

Based on the final ratings assigned by the Chair and the OECD Secretariat, and reconsidering the distribution of initial ratings by experts, practices were systematically categorised into three evidence levels – high, medium, or low – reflecting the level of consensus on their positive causal impact on student outcomes. These categories were based on the number and quality of the studies, how consistent the findings were, and how well the evidence applied to different educational contexts, subjects, and levels. Alongside this, for each practice, the limitations in the evidence base for each practice were collated and synthesised. This involved the limitations identified by the Informal Expert Group's background documents as well as the limitations identified in the qualitative insights by experts in the consultation process.

Strengthening the review process through a literature review

A literature review was commissioned to two independent reviewers in order to further examine the evidence available on the practices included in the Taxonomy. One purpose of the review was to check

for bias and increase coverage in the evidence drawn upon by the Informal Expert Group in the background documents. This would allow a larger pool of evidence to be used in developing the final report. A second purpose was to also check for potential bias or oversight in the groupings of practices based on the expert consultation.

This literature review was designed following established evidence synthesis methodologies, ensuring that the breadth and depth of the analysed literature met the standards of reliability and validity. In particular, the protocol considered the following explicit inclusion and exclusion criteria:

- Type of Studies: The highest possible standard of evidence was used; when available, quantitative meta-analytic syntheses of randomised control trials or quasi-experimental designs.
- Population: Studies focusing on teachers in mainstream school settings in primary and secondary education levels (ISCED 1 to 3).
- Intervention: Inclusion of teaching practices, methodologies, and pedagogical approaches relevant to a specific sub-dimension.
- Outcomes: Measurable effects on student cognitive and non-cognitive performance as defined by the OECD Education 2030 Compass.
- Time Frame: Studies published post-2000, and, where a large meta-analysis exists for a sub-dimension, since the meta-analysis' publication.
- Geographies and Language: Studies published in English or with available English translations.

The data sources and search strategy involved using keywords related to the sub-dimension and its associated terms to search databases such as ERIC (Education Resources Information Center) and Scopus. A data collection form was used to standardise the capture of study design features, methodology, findings, limitations, and conceptual alignment to the Taxonomy.

This meant that, overall, some 500 references have been considered (with some duplication) across the teaching goals of the Taxonomy: Classroom Interaction (95), Cognitive Engagement (139), Formative Assessment and Feedback (69), Quality of Subject Matter (88), Social-Emotional Support (171). It is also important to note that this distribution is informed by the strength of conceptualisations in different goals and also the nature of different evidence bases. For instance, high-quality meta-analyses are available for Formative Assessment and Feedback whilst similar references were missing for Cognitive Engagement and Social-Emotional Support. This is also reflected in the outcomes of the expert review process.

Goal 3: Gathering and systematising insights from schools

A further feature of the work of the Schools+ Network has been to gather and systematise teachers' and school leaders' professional knowledge through the Schools Learning Circle. From November 2023 to November 2024, over 150 schools have contributed to the Schools+ work.

Recruitment of schools

Schools were nominated by participating organisations and ministries of the Schools+ Network. Each organisation or ministry were invited to nominate up to 10 schools. To facilitate the selection of these schools, a detailed guideline with criteria for the selection of schools was provided, this included the following criteria:

- Primary and/or secondary schools from different geographical areas and different socio-economic groups

- Be among the most pioneering establishments in their respective networks, demonstrating high standards of teaching and learning
- Make regular use of research evidence to make decisions and drive their school forward (e.g. working with researchers, engaging in action research, staying abreast of research findings, having strong school self-evaluation processes)
- Engage in innovation and show interest in how to inspire and support other schools to take initiatives to scale
- Passionate about shaping global education, sharing their expertise and co-creating solutions with peers from other countries.

A key expectation was that participating schools were attuned to research and making research-informed decisions that were supported by local evidence from their school context. Schools were recruited by completing an application form where they were asked to share information about the school's characteristics, experience, and initiatives in relation to research and data use. When asked about it in the registration, more than 100 reported having participated in research projects, and nearly all had participated in competitions and local networks. Many schools also reported that they made use of different mediums for self-evaluation of in-school initiatives (e.g. assessment and student data, teacher questionnaires or testimonials). Schools were asked to include at least one member of the school leadership team and one member of the teaching staff, and were encouraged to form an in-school team of at least three staff members to allow for discussion and the development of synthesised school answers, with the following guidance for teams.

The majority of schools in the Learning Circle were public schools, with a reasonably equal split between those that catered to the primary, secondary or both primary and secondary levels (see Table A A.5). A notable proportion had a significant number of disadvantaged students based on their own estimates. The mean number of students per school was 934, and the mean number of teachers 88. Overall, it means that the Learning Circle has worked with schools that encompass more than 130 000 students and 12 000 teachers.

Table A A.5. Characteristics of participating schools (level of education, ownership, level of disadvantage, country, number of participants from schools)

	Number of schools	Proportion
School ownership		
Public	110	73%
Private	31	20%
Not available (n.a.)	10	7%
Total	151	100%
Level of education		
Primary	41	27%
Secondary	50	33%
Primary and secondary	60	40%
Total	151	100%
Self-estimated proportion of disadvantaged students		
0%	11	7%
1-10%	43	29%
11-30%	41	27%
31-60%	26	17%
Over 60%	14	9%
Not available (n.a.)	16	11%
Total	151	100%

There is also a notable geographic spread in the participating schools as shown in Table A A.6. A total of 84 schools were nominated by governments (national and local) from OECD member and non-member countries and 67 schools were nominated by other Schools+ participating organisations.

Table A A.6. Geographical spread of participating schools

Country	# of schools	Country	# of schools
Australia	1	Türkiye	7
Belgium	3	England (United Kingdom)	9
Canada	8	Scotland (United Kingdom)	11
Chile	2	Wales (United Kingdom)	1
Croatia	6	United States	10
Denmark	3	Argentina	6
Helsinki-Finland	3	Bahrain	1
France	3	Bhutan	1
Greece	3	Bulgaria	1
Ireland	1	Georgia	1
Israel	1	Haïti	1
Italy	7	India	3
Japan	1	Liberia	1
Latvia	5	Mongolia	1
Lithuania	4	Nepal	2
Luxembourg	1	Pakistan	1
Mexico	1	People's Republic of China	9
Portugal	9	Qatar	1
Romania	6	Saudi Arabia	1
Slovak Republic	4	South Africa	2
Slovenia	6	Zimbabwe	1
Spain	2		

Forming thematic groups

Schools were organised into five thematic groups based on the five goals of teaching. Schools were asked to choose which of the five thematic groups/goals they were interested in focusing most of their attention on, receiving an overview of the five goals to inform their decision. Schools were encouraged to base their decision on their own practice and which thematic group/dimension they felt was a strength in their school such that they could share and build knowledge on its practices. This would also facilitate more focused reflections and discussions among participants by inviting them to concentrate on a single (if still broad) area of practice rather than teaching as a whole.

Each thematic group was also assigned two 'co-leads'. These were schools who volunteered to undertake this role and expressed an interest in having a larger, more hands-on participation. From the group of interested schools, based on reported experience in working internationally and on specific evidence-informed initiatives in their school, as well as with consideration to geographic spread, a group of 10 co-leads were invited to undertake this important role.

Process to elicit schools' insights

Eliciting schools' insights depended on a series of 'Milestones' that were shared with schools. Schools had a range of different stimuli and different outputs expected from them. Each milestone is outlined here.

Milestone 1 (November 2023) – Building a shared language of teaching and delineating the implementation mechanisms:

- To ensure a common understanding of practices, schools read the background document for their thematic area.
- Schools completed an online survey to share the language and terminology they use to describe practices, as well as their suggestions for how practices were described in terms of implementation mechanisms to inform the early development of insights on these.
- Schools met online to discuss themes across the submissions in their online surveys.

Milestone 2 (December – January 2024) – Identifying in-class signals from students and deepening implementation insights:

- Building on the background chapters still, schools were asked again through an online survey to share the types of in-class signals from students that they attended to when implementing each practice, both in terms of signals that a practice was and was not being effectively implemented.
- To build a richer set of insights on implementation mechanisms, schools were also asked to share how their implementation of different mechanisms in practices varied for different classes and contextual needs.
- Led by the co-leads, schools met online to discuss areas of disagreement in terms of mechanisms of effective implementation and the evolving synthesis of their insights.

Milestone 3 (February – April 2024) – Discussion on the implementation of practices:

- Schools had access to a shared 'live' version of the first draft of the chapters for the report for co-editing.
- A series of question boxes were placed at areas where, based on the previous milestones and discussions, there was still a lack of sufficient professional insights. Schools were invited to either comment on the existing text, share their insights through these question boxes, or engage with the ideas of other schools that had already been shared.
- In particular, schools were asked to share tangible examples of how they respond to particular challenges when implementing the practices to provide more meaningful insights on implementation mechanisms.
- Led by the co-leads, schools met online to discuss and refine the first synthesis of the signals from students based on Milestone 2.

Milestone 4 (June – September 2024) – Scoping the process of change and the enabling contextual factors:

- Schools were invited to share a detailed outline of how they have enacted a substantial change in their school to improve their use of at least one of the 20 practices.
- Schools shared their inspiring practices through a standardised template that had been developed through contributions from the Schools+ Third Community Meeting. This included schools sharing their school-level evidence on its impact and how school leaders had navigated different contextual factors at the school-level to ensure its effectiveness.
- Schools met online to discuss one case study example from a school in detail, and how to ensure that information on contextual factors would be detailed and relevant.

Milestone 5 (October – November 2024) – Understanding the fuller complexity of teaching:

- Schools undertook an expert rating exercise on the complexity of teaching. Schools rated each of the 20 practices for their inherent difficulty and the influence on contextual factors on their implementation. [1] This was completed in an online survey and more information on the rating exercise and the methodology to its processing can be found below.
- Schools also submitted qualitative insights on the types of effective instructional leadership practices that can help create a supportive environment for high-quality teaching.
- Schools met online to discuss in more detail the types of effective instructional leadership practices that respond to different contextual factors.

Milestone 6 (December – March 2024) – Exploring instructional leadership for change:

- Schools were provided with a background document on strategies to support teachers to refine their skills and create supportive environments (the initial draft of Chapter 8) in a 'live document' format, including the tentative results from the above rating exercise (Milestone 5).
- Schools were asked to share their feedback on how different contextual factors shape high-quality teaching and provide further insights from their own experiences of navigating these factors.
- Schools were given access to peer review the inspiring practices of their peers. In particular, the review focused on eliciting more detailed insights around how schools have gone through processes of change to shift behaviours and mindsets around practices.

Analysis of school insights

As outlined, two particular types of insights were synthesised for inclusion in the report: insights on responding to key considerations when implementing practices, and real-time student signals that could be used to monitor the effectiveness of implementation. The development and refinement of these insights consisted of the following features:

- **Triangulation of different data sources:** Thematic analysis for the insights was conducted in an iterative way as additional school-level data was collected. Initial codes from Milestone 1 were steadily refined in a multi-step way, incorporating data from additional milestones.
- **Practice-by-practice analysis:** A decision was taken to use individual practices as the primary unit of analysis; each group had different practices that had their own set of particular implementation considerations and signals, both of which could be highly variable.
- **Ongoing opportunities for collective refinement:** There were opportunities for co-leads to review emerging themes from the data analysis, and space for discussion among schools in their thematic group meetings to consider themes and certain areas lacking clarity (e.g. particular signals, certain responses to key considerations).
- **Monitoring participation to ensure breadth of expertise:** Participation rates across milestones were attended to ensure a diversity of perspectives were being heard from.
- **Links to other OECD frameworks:** Student signals were mapped to the Education2030 Learning Compass to provide greater coherence when interpreting and discussing them.
- **Additional checks:** After synthesising insights and signals, original data was returned to schools for an additional check and shared with a broader number of schools.

Analysis of school ratings on complexity

As part of Milestone 5, schools were asked to complete two ratings for each of the 20 practices drawing upon their expertise:

- "What is the level of difficulty for an expert teacher to execute this practice, regardless of contextual factors?"
- "What is the level of influence of contextual factors (external to the expert teacher) on this practice?"

Schools were given guidance on how to approach the ratings[2] and given an example of the type of rating page they would be using accompanied by an example of how to rate with both scales a non-classroom example[3]. Even if participating schools were already expected to be familiar with the definitions for each practice, the definitions were included for clarity.

Practices were presented in a random order to improve reliability. A 7-point Likert scale was adjudged to be best for capturing more variability in ratings, with 1 representing a very low difficulty or very low influence of contextual factors, and 7 a very high difficulty or very high influence of contextual factors. A question was included that gave raters the opportunity to identify up to five practices on each rating scale that were particularly hard for them to judge (see Table A A.7 and Table A A.8).

Table A A.7. Ratings by schools on the difficulty of practices

	Frequency of assigned ratings								Mean rating	Median rating	Number of raters considering 'hardest to rate'
	1	2	3	4	5	6	7	Total			
Working with multiple approaches and representations	5	17	17	34	32	20	7	132	4.20	4	52
Metacognition	7	17	24	27	32	18	7	132	4.08	4	52
Ensuring appropriate levels of challenge	6	31	18	28	30	12	7	132	3.83	4	40
Explicitly teaching and actively practising skills	5	20	38	25	24	15	5	132	3.82	4	42
Making connections	5	25	30	28	30	10	4	132	3.75	4	32
Adapting to student thinking	14	23	26	22	26	12	9	132	3.72	4	36
Facilitating first-hand experiences	5	30	30	23	24	19	1	132	3.70	4	27
Questioning and responding	11	33	29	23	20	13	3	132	3.45	3	12
Meaningful context and real-world connections	14	31	31	26	12	14	4	132	3.37	3	29
Clarity, accuracy and coherence	16	36	23	20	25	12	0	132	3.29	3	29
Diagnosing student learning	18	30	34	18	17	11	4	132	3.27	3	32
Feedback	18	31	24	31	16	10	2	132	3.26	3	8
Nature of the subject	12	39	25	32	14	8	2	132	3.22	3	15
Crafting explanations and expositions	13	38	32	21	20	6	2	132	3.17	3	29
Building student-student relationships	15	36	32	22	21	6	0	132	3.12	3	12
Nurturing a supportive classroom climate	17	35	35	19	16	9	1	132	3.10	3	11
Student collaboration	18	37	28	23	19	5	2	132	3.08	3	7
Whole-class discussion	20	37	23	26	18	6	2	132	3.08	3	16
Learning goals	26	35	33	15	22	0	1	132	2.82	3	6
Building teacher-student relationships	26	50	24	12	14	5	1	132	2.67	2	9

Note: Practices were rated in a random order by schools. Schools were asked to rate each practice in relation to the question "What is the level of difficulty for an expert teacher to execute this practice, regardless of contextual factors?". Schools rated practices on a 7-point Likert scale, with 1 being 'very low difficulty' and 7 'very high difficulty'. Schools had the option at the end to identify up to five practices that were the hardest to rate for difficulty, by answering the following question "Which practices were the hardest to rate for difficulty?".

The rating instrument was first piloted with 32 schools. Then, all participating schools were then invited to undertake the ratings. 132 school leaders and teachers, from 87 different schools, completed the rating. There were 53 classroom teachers with the rest having school leadership roles. Raters had an average experience of over 19 years working as a teacher. Those who were principals or school leaders had approximately 10 years of experience in leadership roles.

Table A A.8. Ratings by schools on the influence of contextual factors on practice

	Frequency of assigned ratings								Mean	Median	Frequency of being chosen as one of the hardest to rate for contextual influence
	1	2	3	4	5	6	7	Total			
Explicitly teaching and actively practising skills	1	13	15	26	31	28	18	132	4.73	5	35
Facilitating first-hand experiences	0	8	19	30	36	27	12	132	4.69	5	21
Building student-student relationships	2	14	14	30	35	20	17	132	4.59	5	17
Ensuring appropriate levels of challenge	4	10	22	28	27	28	13	132	4.52	5	36
Metacognition	5	12	16	39	23	26	11	132	4.40	4	45
Working with multiple approaches and representations	2	14	20	31	35	18	12	132	4.40	4	40
Nurturing a supportive classroom climate	5	7	28	28	33	19	12	132	4.38	4	13
Making connections	1	9	26	36	28	28	4	132	4.37	4	22
Student collaboration	2	16	26	28	31	19	10	132	4.27	4	17
Whole-class discussion	3	16	27	27	28	22	9	132	4.23	4	18
Adapting to student thinking	3	15	28	31	27	17	11	132	4.20	4	26
Meaningful context and real-world connections	2	23	27	25	26	21	8	132	4.10	4	21
Nature of the subject	4	26	18	33	23	23	5	132	4.02	4	18
Feedback	8	19	23	31	30	12	9	132	3.97	4	14
Questioning and responding	6	17	32	32	23	16	6	132	3.92	4	8
Crafting explanations and expositions	4	25	21	37	24	15	6	132	3.92	4	17
Diagnosing student learning	9	24	28	21	25	20	5	132	3.83	4	23
Clarity, accuracy and coherence	7	24	29	30	19	19	4	132	3.78	4	22
Building teacher-student relationships	3	32	25	29	23	14	6	132	3.78	4	14
Learning goals	8	29	35	19	23	14	4	132	3.59	3	10

Note: Practices were rated in a random order by schools. Schools were asked to rate each practice in relation to the question "What is the level of influence of contextual factors (external to the expert teacher) on this practice?". Schools rated practices on a 7-point Likert scale, with 1 being 'very low influence' and 7 being 'very high influence'. Schools Schools had the option at the end to identify up to five practices that were the hardest to rate for contextual influence, by answering the following question "Which practices were the hardest to rate for contextual influence?".

To process ratings, the decision was taken to organise practices into groups. There was little conceptual value in the specific scores that practices received. It was more meaningful to identify the patterns that captured the relative differences between practices, rather than trying, for example, to quantify specifically how much harder a practice was than another. Analysis of the intra-class correlation suggested reasonable levels of consensus on which practices were more or less difficult, and more or less influenced by contextual factors. There was more limited agreement on the exact difficulty of or contextual influence on a particular practice (e.g. was it a 4 or a 3 on the 7-point Likert scale), which was to be expected on such a scale.

The boundaries of the groups were developed based on the mean average rating, cross-checked with the median and modal ratings. This cross-checking as well as the visualisation of the dataset and its distribution of ratings allowed for appropriate boundaries to be set, even if these boundaries are not fixed

and practices can vary in their difficulty or influence by contextual factors. The final groups were as follows, where x represents the mean average rating across raters:

- Difficulty: Lower difficulty $x < 3.2$, medium difficulty $3.2 \leq x < 3.7$, higher difficulty $3.7 \leq x$.
- Contextual factors: Lower contextual influence $x < 4.0$, medium contextual influence $4.0 \leq x < 4.5$, higher contextual influence $4.5 \leq x$.

Sustained participation

The Schools+ Secretariat requested that schools, under the direction of the 'co-leads' engage in Milestone work and attend regular meetings to report on their progress. The participation of the 150 Schools in the Learning Circle has been consistent, both in terms of Milestone assignments and meeting attendance. This is captured by the rates of participation in the first and last milestones, which show some drop off but reasonably sustained levels of engagement from participating schools. Milestone 1 saw some 111 schools participate whilst Milestone 5's activity, the aforementioned expert rating exercise, saw a total of 132 ratings by school leaders and teachers from 87 schools.

A similar picture emerged in terms of participation in meetings. Meeting participation includes representatives from schools, along with other colleagues from the schools. All of the meetings took place on Zoom and recordings, presentations and other materials were shared with all participants following the meeting, to account for schools that were unable to attend. The meeting attendance is shown below:

Table A A.9. Attendance of schools for the virtual Learning Circle meetings

	Group 1	Group 2	Group 3	Group 4	Group 5
Meeting 1 (Sept 2023)	198 (joint meeting for all groups)				
Meeting 2 (Dec 23)	25	53	46 (joint)		40
Meeting 3 (Feb 24)	22	36	30 (joint)		32
Meeting 4 (April 24)	429 (joint meeting for all groups)				
Meeting 5 (June 24)	301 (joint meeting for all groups)				

Chapter endnotes

[1] Note that contextual factors is referred to as environmental factors in Chapter 8.

[2] Schools received the following guidance for each rating question:

- The first question asks how difficult you think a specific teaching practice is to do in its highest quality form. This doesn't imply that teaching as a whole isn't difficult - teaching is complex, and different practices vary in difficulty. The question is framed around how difficult it is for an expert teacher to do this practice. This is based on the logic that what is difficult for those who are regarded as excellent at teaching is difficult for other teachers too. To determine the level of difficulty, please consider factors such as the levels of knowledge demanded, the level of adaptation and flexibility to student needs, or the level of multitasking required.
- The second question asks you to assess the extent to which doing that practice in its highest form is influenced by factors external to the teacher. Teaching is always highly context-based, but certain practices may depend more on contextual factors than what the teacher does. To

determine the level of influence, please consider contextual factors such as curriculum and materials, class size and student characteristics, resources, staff collaboration, parental involvement, school policies etc.

[3] The example was "*For example, conducting a meeting with parents to discuss a student's low attendance is inherently more challenging than a procedural task like recording attendance at the start of a lesson. The meeting is more influenced by contextual factors - such as school policies, parental engagement strategies, and the student's background - compared to the routine task of taking attendance*."

Annex B. List of contributors

Schools+ Network Participants

Table A B.1. Participants from OECD member and non-member countries

Country	Organisation	Representative(s)
Belgium (German-speaking community)	Ministry of the German-speaking Community of Belgium	Ruth De Sy, Head of Pedagogy
		Myriam Wolkener, Educational Officer
Belgium (Flanders)	GO! scholengroep 20, Flanders Ministry of Education	Isabelle Janssens, Director
Colombia	Institute for the Evaluation of Education (ICFES)	Elizabeth Blandon Bermudez, General Director
		David Mauricio Ruiz Ayala, Officer (former)
Finland	City of Helsinki, Education Division	Marjo Kyllönen, Development Service Director
France	Direction générale de l'enseignement scolaire	Cécile Pacchiana-Rossi, Director (former)
		Magali Villain-Lopes, Director*
Italy	Ministry of Education	Ing. Davide D'Amico, General Director for Digital Innovation Simplification and Statistic
		Rossana Latronico, Officer
		Ezia Palmeri, Director of Digital Innovation in Education
Latvia	Ministry of Education and Science	Kristine Niedre-Lathere, Deputy State Secretary
	National Centre for Education of Latvia	Liene Voronenko, Head of the National Centre for Education
	Permanent Delegation of the Republic of Latvia to the OECD	Laura Treimane, Counsellor for Education and Science
Lithuania	Vilnius Education Improvement Centre "Edu Vilnius"	Une Kaunaite, Director
	Permanent Delegation of Lithuania to the OECD	Jurgita Petrauskiene, Counsellor for Education and Science
Luxembourg	Institut de formation de l'éducation nationale	Élise Aubert, Executive Assistant
		Christian Lamy, Director
Norway	Oslo Municipal Education Authority	Tore Haugen, Superintendent Marianne Skogvoll, Supervisor
	Norwegian Delegation to the OECD and UNESCO	Bjørn Kjellemo, Education and Research Counsellor
Portugal	Directorate-General for Education - Ministry of Education, Science and Innovation	Elsa Belo, Representative of the Directorate-General for Education*
	Ministry of Education, Science and Innovation	Luisa Ucha Silva, Assistant to the Minister for Education (former)
Scotland, United Kingdom	Education Scotland	Ollie Bray, Strategic Director
		Dave Gregory, Strategic Director
		Patricia Watson, Strategic Director (former)
Slovak Republic	Ministry of Education, Science and Sport	Mária Orlovská, Project Manager
		Peter Rašo, Advisor
		Michal Rybar, Director for Digital Transformation
	Permanent Delegation of the Slovak Republic to the OECD	Peter Gottlieber, Third Secretary
Slovenia	Ministry of Education	Petra Bevek, Undersecretary, Digital Education Service
		Mateja Brejc, Secretary, Digital Education Service
		Saša Ambrožic Deleja, Senior Advisor, Education

Country	Organisation	Representative(s)
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		Polona Knific, Undersecretary, Education Development and Quality Office
	National Education Institute Slovenia	Stanka Preskar, Assistant Director
	Permanent Representation of Slovenia to the OECD	Ana Strnad Tomasi, Counsellor
Sweden	Swedish Institute for Educational Research	Alva Appelgren, Research/Project Manager
		Helena Bergmark, Director of Education
		Jonna Wiblom, Director of Education
Switzerland	Swiss Conference of Cantonal Public Education	Bernard Wicht, Head of International Affairs
	Swiss Association of Headteachers	Thomas Minder, President
	ProEDU	Monica Macary, Co-Director
		Michael Kubli, Co-Director
Türkiye	Ministry of Education	Mehmet Fatih Döger, Section Director
		Seyma Nur Dündar, Expert
		Ayse Mingir, National Education Expert
		Mustafa Saygin, National Education Expert
European Union	European Commission	Ulrike Storost, Head of Sector, Online Education Platforms
Bulgaria	Ministry of Education	Nayden Chivarov, Director, National STEM Centre
		Krassimira Todorova, Chief Expert, International Cooperation
Croatia	Ministry of Science and Education	Katarina Grgec, Head of Department
		Iva Ivankovic, State Secretary
	Association of Secondary School Principals	Suzana Hitrec, President
	Association of Primary School Principals	Antonija Mirosavljevic, Director
People's Republic of China	China National Academy of Educational Sciences (CNAES)	Li Yongzhi, President of CNAES
		Wang Ming, Vice President of CNAES
		Ma Kai, Director of Department for General Affairs, CNAES
		Deng Youchao, Executive Deputy Director of National Office of Education Sciences Planning, CNAES
		Ma Xiaoqiang, Director of Institute of Education Statistics and Data Analysis, CNAES
		Li Tie'an, Director of Institute of Basic Education, CNAES
		Wang Jian, Director of Institute of Education Finance, CNAES
		Xu Congcong, Deputy Director of Department for International Exchanges, CNAES
Romania	Ministry of Education	Bogdan Cristecu, Secretary of State
	International Relations and EU Affairs	Camelia Mircea-Sturza, Advisor
South Africa	Ministry of Education	Boitumelo Butjie, Education Officer
		Neo Mothobi, Education Officer

*Participant in the Schools+ Informal Advisory Group

Table A B.2. Participants from other organisations

Organisation	Representative(s)
Aga Khan Foundation (Schools 2030)	Andrew Cunningham, Global Co-Lead, Education
	Bronwen Magrath, Global Programme Manager
Council of British International Schools	Colin Bell, Chief Executive Officer
	Janette Quinn, Director of Education and Professional Learning
Creative Schools Program	Gabriela Breviglieri, Executive Director
Digital Promise	Camden Hanzlick-Burton, Associate Director of Onboarding
	Pati Ruiz, Senior Research Scientist
	Heather Singmaster, Director of the Global Cities Education

Organisation	Representative(s)
	Network
	D'Andre Weaver, Chief Digital Equity Officer
	Tom Rooney, Superintendent, Lindsay Unified School District
	Cinnamon Scheufele, Executive Director of Curriculum and Instruction, Lindsay Unified School District, United States
Education Endowment Foundation	Jon Kay, Head of Evidence Synthesis
	Amy Faux, Senior International Manager
	Lizzie Swaffield, National Delivery Manager
Education International	John Bangs, Senior Consultant to the General Secretary
	Jennifer Ulrick, Policy, Research and Advocacy Coordinator*
Edutopia, George Lucas Educational Foundation	Cindy Johanson, Executive Director
European School Heads Association	Petra van Haren, Director*
European Schoolnet	Konstantinos Andronikidis, Education Policy Manager
Eutopía	Luciana Alonso, Director
Global School Leaders	Adhishree Parasnis, Communications Manager
	Animesh Priya, Director of Partnerships
	Aniket Thukral, Senior Director, Programs
	Tamara Philip, Director of Programs
Global Schools Forum	Kavita Rajagopalan, Director
HundrED	Crystal Green, Research Director
	Heini Karppinen, Chief Operating Officer
	Lasse Leponiemi, Executive Director
International Baccalaureate	Nicole Bien, Head, Chief Schools Officer
International Confederation of Principals	Peter Kent, President* Sofia Hughes, Executive Secretary*
Jacobs Foundation	Samuel Kembou, Knowledge and Learning Manager*
	Romana Kropilova, Program Manager
	Nora Marketos, Co-Lead, Learning Schools (former)
Keller Education	Brad Keller, Chief Executive Officer
	Gavin Keller, Founder
LEGO Education	Bo Stjerne Thomsen, Head of Educational Impact
LEGO Foundation	Patrícia Castanheira, Senior Research Specialist*
	Lena Venborg Pedersen, Initiative Lead, Systemic Impact (former)
	Stuart McAlpine, Initiative Lead, Playful Learning Programme (former)
Magis Qualis	Miguel Garcia Domingos, Principal Consultant
Networks of Inquiry and Indigenous Education (British Columbia, Canada)	Judy Halbert, Co-Director
	Linda Kaser, Co-Director
	Jordan Kleckner, Director of Instruction of Learning & Innovation, Central Okanagan Public School District
	Jon Rever, Assistant Superintendant, Director of Instruction of Learning & Innovation, Central Okanagan Public School District
	Jamie Robinson, Assistant Superintendant, Director of Instruction of Learning & Innovation, Central Okanagan Public School District
OBESSU	Gilda Isernia, Projects and Research Officer
	Anna Sofia Dalhof Weinrich, Board Member
Osvitoria, Ukraine	Anna Sydoruk, Chief Executive Officer
Red de Escuelas Líderes — Fundación Minera Escondida, Fundación Educacional Arauco, Fundación Educacional Oportunidad, Fundación Chile, El Mercurio	Marcela Colombres, Director
	Pablo Casanova Ponce de León, Director of Projects
Results for Development (SALEX)	Mark Roland, Program Director
	Laurel Schmitt, Senior Program Officer
	Courtney Tolmie, Senior Fellow

Organisation	Representative(s)
SUMMA (Laboratory of Education Research and Innovation for Latin America and the Caribbean)	Javier Gonzalez, Director and Co-Founder*
	Karla Fernandini, Director of Strategic Development
T4 Education	Vikas Pota, Founder and Chief Executive Officer
	Marin Maurette, Head of Prizes
Teach for All	Anna Molero, Chief Government Officer
	Vikas Plakkot, Director of Alumni Leadership Pathways
Transcend Education	Dariana Castro, Partner
UNESCO	Valérie Dijoze-Gallet, Education Programme Specialist*
Varkey Foundation	Rebecca Warbrick, Head of Marketing
VVOB	Tom Vandenbosch, Global Director of Programmes
World Federation of Associations of Teacher Education	Davide Parmigiani, President

*Participant in the Schools+ Informal Advisory Group

Experts

Table A B.3. List of members of the Informal Expert Group and the scoping reviewers

Informal Expert Group	
Jenni Ingram (Chair)	University of Oxford
Jill Adler	University of the Witwatersrand
Joseph Krajcik	Michigan State University
Kathy Hirsh-Pasek and Annelise Pesch	Temple University
Steven Puttick	University of Oxford
Robyn Gillies	The University of Queensland
Victoria Elliott	University of Oxford
Scoping Review	
Cindy Ong	University of Oxford
Louise Vincent	University of Oxford

Table A B.4. List of experts contributing to the review of the evidence

Academics and Other Experts	
Amy Roth McDuffie	Washington State University
Anouschka van Leeuwen	Utrecht University
Arne Jakobsen	University of Stavanger
Christina Kundrak & Emily Gonzalez	University of Southern California
Christine Howe	University of Cambridge
Daniel Muijs	Queen's University Belfast
Hamish Chalmers	University of Oxford
Jennifer Fredericks	Union College
John Perry	University of Nottingham
Juliette Berg	American Institutes for Research
Kelly-Ann Allen	Monash University
Klaus Zierer	Augsburg University
Kristin Lesseig	Washington State University
Leonidas Kyriakides	University of Cyprus
Mark Greenberg	Penn State University
Mercy Kazima	University of Malawi
Neil Mercer	University of Cambridge
Penelope Watson	University of Auckland

Sibel Erduran	University of Oxford
Steve Higgins	Durham University
Knowledge Brokerage Organisations	
Annika Wilmers	DIPF | Leibniz Institute for Research and Information in Education, Germany
Christopher Harris	West Ed, US
Ellen Smith & Bronwen Magrath	Schools2030 (Aga Khan)
Jonathan Kay & Lizzie Swaffield	Education Endowment Foundation, United Kingdom
Lou Aisenberg	Abdul Latif Jameel Poverty Action Lab
Sonia Guerriero	UNESCO

Table A B.5. Academics and organisations contributing qualitative input during the review of practices

Academics and other experts	
Hamsa Venkatakrishnan	Dublin City University
Karin Brodie	University of the Witwatersrand
Joanna McIntyre	University of Nottingham
John Sweller	University of New South Wales
Michael Thomas	Birkbeck University
Susan Groundwater-Smith	University of Sydney
Contributor	**Organisations**
Elaine Munthe	Knowledge Centre for Education
Javier Gonzalez	SUMMA (Laboratory for Research and Innovation in Education for Latin America and the Caribbean)
Isabelle Janssens	Leerpunt
Tom Vandebosch	VVOB
Rebecca Warbrick	Varkey Foundation
Crystal Green	HundrED
Heini Karppinen	
Lasse Leponiemi	
Bo Stjerne Thomsen	LEGO Education
Patrícia Castanheira	LEGO Foundation
Hanne Jensen	
Lena Venborg Pedersen	
Nicole Bien	International Baccalaureate
Luciana Alonso	Eutopía
Miguel Garcia Domingos	Magis Qualis
Gilda Isernia	OBESSU
Anna Sofia Dalhof Weinrich	

Schools+ has also benefited from feedback from a range of different contributors during the development of this work. These include Rosanne Zwart (Netherlands Initiative for Education Research - NRO), Jonathan Sharples (EPPI Centre - Evidence for Policy & Practice Information Centre), Tijana Breuer (Maastricht University), Moira Faul (NORRAG - Network for International policies and cooperation in education and training), Matthew Soldner (National Centre for Education Evaluation and Regional Assistance), Yvonne Lijekvist (Karlstad University, Sweden & ULF Initiative), Toby Greany (University of Nottingham) and Chris Brown (University of Southampton).

Participating schools

Table A B.6. Schools nominated by government authorities (national or local) of OECD member and non-member countries

Country	School name
Belgium (German-speaking community)	Bischöfliche Schule
	Robert-Schuman-Institut
Belgium (Flanders)	Basisschool GO! Hofkouter
Finland	Kalasatama elementary school
	Nordsjö lågstadieskola
	Hiidenkivi Comprehensive School
France	Lycée Paul Duez Cambrai
	Collège Simone de Beauvoir
Greece	33rd Primary School
	3rd General Lyceum of Trikala 'Odysseas Elytis
	1st High School Of Kalampaka
Italy	Istituto Comprensivo Di Govone
	Istituto Comprensivo 3 di Modena
	IC Calvino
	Liceo Teresa Gullace Talotta
	ISS ETTORE MAJORANA
	ISI Sandro Pertini
Latvia	Rigas 72.vidusskola
	Friendly Appeal Cesis State Gymnasium
	Valmieras 5th Secondary School
	Private Secondary school "Patnis"
	Marupe State Gymnasium
Lithuania	Vilnius Sostines gymnasium
	Vilniaus Volunges kindergarten-school
	Vilnius Maironis progymnasium
	Vilnius Barbora Radvilaite progymnasium
Luxembourg	Lycée Michel Rodange Luxembourg
Portugal	Escola de Comércio de Lisboa - ECL
	Marinha Grande Poente School Cluster
	Agrupamento de Escolas de Albergaria-a-Velha
	Agrupamento de Escolas Gil Paes
	Agrupamento de Escolas de Alcanena
	Agrupamento de Escolas José Estêvão
	Escola Secundária Quinta das Palmeiras - Covilhã Portugal
	Agrupamento Escolas do Barreiro
	Escola Portuguesa São Tomé e Príncipe
Slovak Republic	Základná škola Námestovo, Komenského ul
	ZŠ s MŠ Gaštanová 56, Žilina
	Súkromná základná škola BESST (Bilingual Englis/Slovak Primary and Secondary School BESST)
	Základná škola s materskou školou, Školská 238, Zubrohlava
	Zakladna škola s materskou školou
Slovenia	Primary School Tišina
	Primary School Bistrica
	School Centre Novo mesto
	Primary School Dobje
	Primary School Trnovo
	Primary School Gornja Radgona

Country	School name
Türkiye	Sisli Bilim ve Sanat Merkezi (SISLI BILSEM)- Sisli Science and Art Centre
	Mamak Bilim ve Sanat Merkezi/Mamak Science and Arts Centre
	Yunuslar Ortaokulu
	Özdemir Gurocak Primary School
	Nermin Metin Akar Middle School
	Antalya Kepez Bilim ve Sanat Merkezi
	Küçükkizilhisar Secondary School
Scotland (United Kingdom)	Woodburn Primary School
	Wallace Hall Academy
	St Patrick's Primary
	Moffat Academy
	Lasswade High School
	Calderglen High School
	Carrick Academy
	Allan's Primary School & Nursery
	Muirkirk Primary School and ECC
	Barony Campus
Bulgaria	Hristo Smirnenski
Croatia	Elementary School Brodarica
	V. gimnazija Vladimir Nazor Split
	Osnovna škola Manuš
	Elementary school Trnsko
	Ekonomska i upravna škola Osijek
	Prva rijecka hrvatska gimnazija
People's Republic of China	Shanghai Huangpu Luwan No.1 Central Primary School
	Chongqing Xiejiawan School
	Hongxinghai International School
	Shanghai Yan'an Middle School
	Beijing Haidian Minzu Primary School
	Beijing Navigation School
	Chengdu Shishi Union Middle School
	Nanyou Primary School
	Chengdu No.7 middle school
	National Institute of Education Sciences Liwan Experimental School
Romania	Colegiul National Liviu Rebreanu Bistrica
	Liceul Teoretic German IDEES
	Liceul Tehnologic "Carol I" Valea Doftanei
	Secondary School No. 4 Elena Donici Cantacuzino
	Colegiul National Iasi

Table A B.7. Schools nominated by other organisations

Nominating organisation	School name and country
Council of British International Schools	St Christopher's School, Bahrain
	ma kindy School, Réunion Island
	British International School of Tbilisi, Georgia
	DSB International School, India
	British School in Tokyo, Japan
	British School of Ulaanbaatar, Mongolia
	Doha College, Qatar
	Avenor College, Romania
	British International School Riyadh, Saudi Arabia

Nominating organisation	School name and country
Digital Promise	Kennedy Learning Community, United States
	Washington Learning Community, United States
	Roosevelt Learning Community, United States
	Lincoln Learning Community, United States
Education Endowment Foundation	Huntington Research School, United Kingdom
	Greetland Academy, Great Heights Academy Trust, United Kingdom
	Durrington High School, United Kingdom
	The Blue School, United Kingdom
	Lyons Hall Primary School, United Kingdom
	Alexandra Park Primary School and Research School, United Kingdom
Eutopía	Instituto San José de Villa del Parque, Argentina
	The Global School, Argentina
	Instituto Mario Fabian Alsina, Argentina
	St Ignatius´ College, Argentina
HundrED	The Royal Academy, Bhutan
International Baccalaureate	Woodleigh, Australia
	Indus International School, India
	Younited Givat Haviva International School, Israel
	Western Academy of Beijing, People's Republic of China
	Colegio Internacional de Sevilla San Francisco de Paula, Spain
	Wilmington Academy (Leigh Academies Trust), United Kingdom
	International Academy, United States
	Signature School, United States
International Confederation of Principals	Bishop Galvin National School, Ireland
	School 360 (Big Education Trust)
Keller Education	Paarl Boys' Primary School, South Africa
	Westville Girls High School, South Africa
LEGO Foundation	International School of Billund, Denmark
	Skovvangskolen, Denmark
	Læringshuset, Denmark
Networks of Inquiry and Indigenous Education (British Columbia, Canada)	George Elliot Secondary School, Canada
	Canyon Falls Middle School, Canada
	Rose Valley Elementary School, Canada
	Pearson Road Elementary School, Canada
	James McKinney Elementary School, Canada
	Mount Sentinel Secondary School, Canada
	Winlaw Elementary School, Canada
	Dixon Elementary, Canada
New Pedagogies for Deep Learning	Hampden Meadows, United States
	Barrington Middle School, United States
	Nayatt Elementary School, United States
	Barrington High School, United States
Red de Escuelas Líderes — Fundación Minera Escondida, Fundación Educacional Arauco, Fundación Educacional Oportunidad, Fundación Chile, El Mercurio	Liceo Bicentenario de Excelencia Polivalente San Nicolás, Chile
	Colegio Saint Matthew, Chile
Roberto Rocca	Roberta Rocca Technical School, Argentina
	Roberto Rocca Technical School, Mexico
T4	ISIS Europa, Italy
	Beaconhouse School Gulshan Campus, Pakistan
	Dunoon Grammar School, Scotland (United Kingdom)
	Trilema Zamora, Spain

Nominating organisation	School name and country
	Barham Primary School, United Kingdom
	Cadoxton Primary, Wales (United Kingdom)
	Eveline High School, Zimbabwe
Teach for All	Michael Ham, Argentina
	Ecole Mixte les Amis du Développement de Madame-Cyr, Haïti
	Capernaum Baptist School System, Liberia
	Jana Uddhar Secondary School, Nepal
	Namaste Academy, Nepal
Varkey Foundation	Shri Vile Parle Kelavani Mandal CNM School, India

Unlocking High-Quality Teaching

In an era of rapid change, it is important to not lose sight of the potential of high-quality teaching and the power of refining teaching practices that have demonstrated impact. This report aims to deepen understanding of the complexities of teaching and its multifaceted nature as a discipline grounded in scientific research, but so too an art requiring creativity and a craft necessitating constant collaborative reflection and improvement.

Focusing on 20 practices that support five key goals of high-quality teaching, this report draws from extensive research to delineate what we know – and what remains to be understood – about each. It also has built on the qualitative insights of more than 150 schools from 40 countries to better understand the complex realities of implementing these practices in day-to-day teaching.

Achieving high-quality teaching is not a solitary pursuit; it also depends on the school environment, and the report explores how school leaders can enable high-quality teaching. This report can be of interest for anyone committed to educational improvement, helping to spark the incremental gains that can ignite change in our classrooms and education systems.

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