Educational Practices Series

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Responsive Teaching: Principles for Instructional Agility

by Dr Carl Hendrick

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International Bureau of Education

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The series is also a result of the IBE's efforts to establish a global partnership that recognizes the role of knowledge brokerage as a key mechanism for improving the substantive access of policymakers and diverse practitioners to cutting-edge knowledge. Increased access to relevant knowledge can also inform education practitioners, policymakers, and governments on how this knowledge can help address urgent international concerns, including but not limited to curriculum, teaching, learning, assessment, migration, conflict, employment, and equitable development.

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Introduction

Every teacher knows this experience: you teach something, the students appear to understand it, they can answer your questions, they complete the practice successfully. You're confident they've learned it. Then two days later, you refer back to what you taught and you're met with blank stares. It's as if the lesson never happened. This isn't about a few struggling students, it's most of the class. What looked like solid understanding has somehow disappeared. Why is this?

A deceptive truth about learning is that it's not linear but recursive: understanding develops gradually and often incompletely. What appears to be mastery during a lesson can reveal itself as only partial understanding when students encounter the same content in new contexts weeks later. This is the fundamental problem responsive teaching addresses: the fact that misunderstandings frequently emerge *after* learning is judged to have taken place.

Every classroom brings together students with different levels of prior knowledge, motivation, and readiness. A student who successfully completes practice problems may struggle to apply the same concept the following week. A student who can recite a definition may revert to everyday misconceptions when reasoning about real situations. Initial fluency often masks fragile understanding that deteriorates over time or fails to transfer to new contexts.

Responsive teaching refers to this continual process of adapting instruction to evidence of student learning across time, not just during initial teaching. It is the practical application of what research on cognition and assessment has shown: that teachers must make constant decisions based on students' thinking rather than assumptions about progress, and that these decisions must extend beyond the moment of instruction to include ongoing monitoring and adjustment.

Across countries and systems, teachers face similar challenges. Students rarely learn in predictable ways, misconceptions often remain hidden beneath apparently correct performance, and teaching time is limited. Cognitive science has demonstrated that learning occurs when students connect new information to existing knowledge, practice retrieving it from memory with appropriate spacing, and receive feedback that corrects misunderstanding. Yet these processes rely on the teacher's capacity to notice not only when initial learning has occurred, but also when apparently secure understanding has proven fragile.

This booklet presents ten principles of responsive teaching. Each principle summarizes what is known about how learning occurs and how teachers can act on that knowledge. The goal is not to prescribe techniques but to clarify the reasoning that underpins instructional flexibility. While contexts vary, these principles focus on fundamental aspects of how humans learn and form concepts, processes that appear consistent across cultures even as their applications must be adapted locally.

Responsive teaching requires more than good intentions: it depends on clarity of purpose, sensitivity to evidence gathered across time, and the professional skill to adapt without diluting expectations. Because learning is recursive and misunderstandings emerge gradually, teaching must be fundamentally and continuously responsive.

1.
Connect to Prior Knowledge

Students learn more effectively when instruction begins with connections to prior knowledge and clear goals.

Research Findings

Connecting new ideas to what students already know gives them a clearer framework for understanding and helps teachers surface misconceptions early. When goals are vague, students struggle to organise new ideas within existing mental structures. When prior knowledge is ignored, misconceptions can interfere with understanding. Research shows that comprehension and memory depend on integrating new information into what students already know. Students need support that helps them see how new learning fits within their existing understanding. Importantly, prior knowledge includes not only information learned in the classroom but also the intuitive ideas students have developed from their everyday observations and experiences. These everyday theories can be powerful resources for learning, but they can also contain misconceptions that teachers need to identify and address.

A short overview at the start of a topic (sometimes called an *advance organiser*) can prepare students for new learning. It can help students activate relevant background knowledge, focus attention on key concepts, and form expectations about what they will learn. This preparation makes subsequent instruction more efficient because students can more easily connect new information to what they already know. When students understand the purpose of their learning and how it connects to previous lessons, they are more likely to engage meaningfully with content rather than approaching it as isolated facts to memorise.

In the classroom

Clarifying intentions involves more than displaying a learning objective on the board. It requires explaining why the concept matters and how it fits into a larger sequence of learning. For example, a science teacher might situate a lesson on ecosystems within the broader question of how energy moves through living systems, helping students understand that they are building toward a comprehensive understanding of biological systems. A mathematics teacher might explain that today's work on fractions builds on their understanding of division and will later help them understand percentages and ratios.

Activating prior knowledge can take several forms. Brief prompts such as ″What do you remember about photosynthesis?″ or ″Who can remind us what we learned about the water cycle?″ help students retrieve relevant information. Teachers might use a quick retrieval quiz, a brief discussion of familiar examples, or a ″think-pair-share″ activity where students first recall what they know individually, then discuss with a partner. Some teachers use graphic organizers like KWL charts (What I Know, What I Want to know, What I Learned) to help students articulate their existing knowledge and identify gaps.

Responsive teachers make these connections explicit rather than assuming students will make them independently. They might say, ″Remember when we studied the American Revolution last month? Today we′re going to see how some of those same ideas about rights and representation influenced events in France.″ This explicit linking helps students build coherent mental frameworks rather than treating each topic as disconnected information.

When lessons start with clear purpose and context, several benefits follow. Students' attention is focused on what matters most. Students can process new information more efficiently because they have a framework for organizing it. Misconceptions can be detected early when teachers ask students to articulate what they already believe about a topic. The investment of a few minutes at the start of a lesson in clarifying goals and activating prior knowledge typically pays dividends in deeper understanding and better retention.

Teachers can also check the effectiveness of their goal-setting and prior knowledge activation by asking follow-up questions: ″Why do you think we′re learning about this?″ or ″How does this connect to what we studied before?″ Such questions help ensure that students have truly grasped the learning orientation and can articulate connections for themselves.

References: Ausubel (1968); Anderson & Pearson (1984).

2.
Maintain High Expectations

Maintaining high expectations while adjusting support helps all students develop confidence and competence.

Research Findings

Students benefit when teachers maintain challenging goals while adjusting the means of reaching them. Lowering expectations in response to difficulty risks creating a self-fulfilling prophecy: students sense reduced expectations and lower their own aspirations accordingly. Research shows that effective teachers calibrate the level of support they provide without compromising demand. They identify what makes a concept difficult and provide temporary assistance that enables success at the intended level of challenge while maintaining ambitious goals for all students.

Research on how the mind processes information explains why well-designed instruction works. When students face overly complex tasks without adequate support, their ability to hold and process new information becomes overloaded and learning breaks down. The mind can only handle a limited amount of new information at once. However, when teachers provide temporary supports, such as breaking tasks into manageable steps, offering worked examples, or providing strategic hints, they reduce unnecessary demands on students' thinking. This frees mental resources for the genuine intellectual work of understanding concepts and developing skills. The key is that these supports must be temporary, gradually withdrawn as competence develops.

Extensive research by Rubie-Davies and colleagues provides further evidence that teacher expectations influence not only achievement outcomes but also classroom culture. High-expectation teachers tend to organise their classrooms differently: they encourage all students to attempt complex tasks, and communicate belief in every learner's capacity for progress. Their students experience classrooms characterised by warmth, challenge, and trust, where feedback focuses on improvement rather than comparison.

In contrast, low-expectation classrooms often limit opportunities for challenge and autonomy, particularly for lower-attaining students. Rubie-Davies's studies show that when teachers consistently convey high expectations through both their interactions and instructional design, students internalise those expectations, increasing effort, resilience, and achievement across ability groups.

In the classroom

Creating a culture of high expectation while providing appropriate support takes many forms depending on student needs and content demands. For complex tasks, teachers might break work into smaller sub-steps, providing explicit guidance for each stage. For instance, when teaching students to write analytical essays, a teacher might first guide students through developing a thesis statement, then work on finding supporting evidence, then focus on paragraph structure, gradually building toward independent essay composition.

Modelling provides another form of support. Teachers demonstrate processes aloud, thinking through decisions and explaining reasoning. Worked examples or paired discussion activities like "turn and talk", where students might briefly discuss with a partner how they identified the key step before trying it independently, give students safe, supported opportunities to practise before full independence. However, as Kirschner and Hendrick note, good teaching is not simply about keeping students busy; it's about ensuring they are thinking about the right things at the right level of challenge.

The language teachers use profoundly affects student motivation and persistence. Statements such as "This is challenging, but we can do it step by step" or "Mistakes are expected when we're learning something new" create a classroom culture where struggle is normalised and support is available. As students develop competence, responsive teachers systematically fade support so that responsibility for learning gradually transfers from teacher to learner.

References: Bloom (1976); Sweller, Ayres & Kalyuga (2011); Kirschner & Hendrick (2020). Rubie-Davies, et. al. (2015)

3.
Check Understanding Regularly

Teachers who check student understanding regularly can make more informed instructional decisions.

Research Findings

Effective responsive teaching depends on a steady flow of evidence about student thinking. This requires deliberate techniques for checking understanding that go beyond asking "Does everyone understand?" (which typically elicits silence or responses only from confident students) or relying on volunteers to answer questions (which provides data only about a few students). Research shows that when teachers systematically gather information about what students are learning and use that information to adjust their teaching — a process sometimes called formative assessment — they can make more precise instructional decisions and accelerate progress for all learners.

The timing and frequency of these checks matters. Checking understanding is most useful at key transition points; before moving from one concept to another, before releasing students to independent practice, and before concluding a lesson or unit. Waiting until a summative test to discover misunderstandings means that errors may have become entrenched and require more extensive intervention to correct.

The purpose of these checks extends beyond identifying who knows the answer. Effective checks reveal patterns of understanding across the class, highlighting which aspects of a concept are secure and which require further attention. They also expose common misconceptions that may be interfering with learning, allowing teachers to address these directly rather than building new learning on faulty foundations.

In the classroom

Checking understanding can take many forms, each suited to different instructional moments and purposes. Quick questions at the start of lessons that ask students to recall what they learned previously serve multiple functions: they activate prior knowledge, reveal what students remember from previous instruction, and provide practice with recall, which itself strengthens memory. Teachers might begin a lesson by asking students to spend one minute listing everything they recall about yesterday's topic, then sharing a few responses to identify gaps or misconceptions.

During instruction, targeted questions that require explanation rather than simple recall expose depth of comprehension. Instead of asking "What is photosynthesis?" (which might elicit a memorized definition), teachers ask "Why do plants need light?" or "What would happen to a plant kept in complete darkness, and why?" These questions require students to demonstrate understanding of relationships and causation, not just factual recall.

Brief written reflections provide evidence from every learner simultaneously, overcoming the limitation of oral questioning which can only sample a few students. Exit tickets which are brief prompts completed in the final minutes of class, are particularly useful. Teachers might ask: "Summarize today's main idea in one sentence," "What is one question you still have?" or "Give an example of today's concept." Reviewing these tickets before the next lesson allows teachers to plan responsive follow-up instruction.

Mini-whiteboards offer another technique for gathering evidence from all students simultaneously. The teacher poses a question, students write responses on individual whiteboards, and then hold them up on a signal. The teacher can quickly scan responses to gauge overall understanding for both individuals and the entire class, identify common errors, and decide whether to move forward or provide additional instruction. This technique works well for problems with clear answers (mathematical calculations, vocabulary definitions, short-answer questions) and can be adapted across grade levels and subjects.

Observation during independent or small-group work provides rich diagnostic information. As students work on tasks, the teacher circulates systematically, watching and listening. Rather than immediately correcting errors, the teacher asks questions to understand student thinking: "How did you decide to do it that way?" or "What were you thinking about when you got stuck?" These conversations reveal not just whether answers are correct but how students are reasoning about content.

Digital tools can also facilitate checking understanding. Classroom response systems allow teachers to pose questions and see aggregate data about student responses, sometimes displayed as charts showing the distribution of answers. While not essential, such tools can make evidence-gathering more efficient.

When checks reveal that many students struggle with the same element, responsive teachers adjust immediately. They might offer an alternative explanation, provide additional examples that illuminate the concept from a different angle, engage students in a demonstration or hands-on activity, or revisit a prerequisite idea that students may not have mastered. When understanding appears solid for most students but a few struggle, teachers might provide targeted support to those individuals while others work independently or offer peer tutoring opportunities.

The culture surrounding these checks matters greatly. Students must trust that revealing confusion or errors will not result in embarrassment or punishment. Teachers cultivate this safety by responding to errors matter-of-factly, treating them as natural parts of learning, and praising students for asking questions or admitting confusion. Over time, students learn that these checks help them learn rather than exposing inadequacy.

References: Black & Wiliam (1998); Wiliam (2018).

4.
Use Misconceptions as Opportunities

Errors are not interruptions to learning but opportunities for deeper understanding.

Research Findings

Decades of research show that most, but not all student misconceptions are systematic, not random. They arise from intuitive but incomplete theories about how the world works, often based on everyday experiences that seem to confirm incorrect ideas. However, not all misconceptions are equal. Research by Michelene Chi identifies three distinct types of conceptual errors, each requiring different instructional approaches.

First, false beliefs are isolated pieces of incorrect information, such as ″the heart oxygenates blood.″ These are relatively easy to correct through direct contradiction and refutation. Second, flawed mental models are more complex: they are coherent but incorrect frameworks that can generate consistent (though wrong) explanations and predictions. A student might have a ″single-loop″ model of blood circulation that makes internal sense but misrepresents how the circulatory system actually works. Third, ontological category mistakes represent the deepest errors. These occur when students assign concepts to fundamentally wrong categories, treating heat as a substance that can be trapped rather than as a process involving molecular motion, or force as a thing rather than a relationship.

Chi describes these persistent misconceptions as ″well-organized misunderstanding″ Students are not simply ignorant; they possess elaborate mental models that work logically within their own framework. The problem is that the framework itself is flawed. Simply providing correct information often fails because students assimilate new facts into their existing incorrect models rather than revising the models themselves. Conceptual change requires more than adding information; it requires confronting and replacing faulty frameworks.

In the classroom

When a teacher identifies a common misconception, the key is not simply to correct it but to design experiences that create cognitive conflict. For false beliefs, direct refutation often works: explicitly state the correct information and contrast it with the misconception. Research shows that when students read texts that directly contradict their false beliefs, most revise their understanding.

For flawed mental models, teachers need a more sophisticated approach. The first step is making the model visible. Teachers can ask students to explain their reasoning, draw diagrams showing relationships, or predict outcomes based on their understanding. Only when the model is explicit can it be examined and revised. The teacher then creates situations where students′ predictions fail, prompting them to recognize contradictions. For example, if students believe plants get mass primarily from soil, the teacher might have them track soil weight in a growing plant and discover that soil mass barely changes while plant mass increases dramatically. This contradiction forces students to reconsider where plant mass actually originates.

For category mistakes—the most stubborn misconceptions—teachers must work at the categorical level. First, students need awareness that they have made a category mistake. The teacher makes this explicit: ″You′re thinking of heat as a thing that can be contained, but scientifically, heat is actually a process; the movement of molecules.″ Second, students need knowledge about the correct category and its properties. The teacher helps build understanding of what processes are (involving change over time, rates, mechanisms) versus what entities are (having mass, location, boundaries).

The ongoing process of gathering evidence about student learning — through questioning, observation, and examination of student work — provides the mechanism for identifying and addressing misconceptions. A simple wrong answer on a test doesn’t reveal whether the error stems from a false belief, a flawed model, or a category mistake. But when teachers ask ″Why do you think that?″ or ″Can you explain your reasoning?″ the underlying mental model becomes visible.

Treating misconceptions as opportunities also fosters intellectual safety. When students see that mistakes are tools for learning rather than causes for embarrassment, they are more willing to share their reasoning. Teachers model this by responding with curiosity: ″That′s interesting, many people think that. Let′s investigate why that idea doesn′t quite work.″ This approach treats errors as windows into student thinking, revealing not just what students don′t know but how they are organizing what they do know.

Effective instruction doesn't just deliver content; it checks for understanding, diagnoses thinking, exposes faulty models, and helps students rebuild frameworks from the ground up. The goal is not simply to replace wrong answers with right ones, but to help students construct accurate and usable mental models.

Suggested readings: Chi (2008); Posner et al. (1982)

5.
Secure Foundations First

Foundational concepts must be thoroughly understood before introducing new material.

Research Findings

In systems driven by coverage and accountability, teachers often feel pressure to move quickly through the curriculum. Yet learning that appears fast can prove fragile. Studies on the illusion of fluency show that apparent ease during practice is a poor indicator of durable learning.

Research on distributed practice emphasises depth before breadth, but understanding how spacing works reveals why this principle is powerful. Recent evidence suggests that during gaps between practice, brains don't simply rest, they continue processing information through mental rehearsal. This ongoing cognitive work strengthens memory traces even when we're not actively studying.

This reveals a paradox: forgetting is not memory's enemy but its ally. When we retrieve information after partial forgetting, our brains engage in more effortful reconstruction that strengthens the long-term memory trace. As Robert Bjork explains, this "desirable difficulty" makes temporary forgetting a feature, not a bug. Spacing is not merely a teaching strategy, it is a scheduling decision that determines when and how the brain consolidates learning.

Prior knowledge fundamentally changes how spacing should work. Students with more background knowledge can mentally rehearse more effectively, potentially benefiting from longer intervals. Novices may need shorter, more frequent spacing to prevent retrieval failure. What counts as "complex" depends on what students already know: material that overwhelms beginners may be straightforward for those with relevant prior knowledge.

In the classroom

Securing foundations requires strategic scheduling of practice over time. When teachers check understanding through retrieval activities such as questioning, low-stakes quizzes, practice tasks, they create opportunities for effortful retrieval that strengthens memory. However, timing matters. Retrieval that occurs too soon creates an illusion of competence. Students recall easily in the moment but struggle later. Initial retrieval needs to be sufficiently challenging.

Teachers should schedule retrieval with increasing intervals: reviewing new content the next day, then three days later, then a week later, then several weeks later. Gaps should be long enough to require effortful retrieval but not so long that students cannot recall at all. The goal is what the Bjorks calls "desirable difficulty"; the optimum range of challenge, enough to strengthen memory without causing complete failure.

What happens during gaps matters. Unrelated, cognitively demanding activities immediately after learning may interfere with mental rehearsal. Brief periods of low-demand activity or related review may support ongoing cognitive processing. Teachers might follow intensive learning with quieter consolidation time rather than immediately moving to completely new, demanding content.

The spacing schedule should adapt as students develop expertise. Early in learning, shorter intervals prevent gaps from becoming too wide. As students can mentally rehearse more effectively, longer intervals become appropriate. A mathematics teacher might review fraction concepts daily initially, then every few days, then weekly, adjusting based on retention evidence.

Retrieval practice should remain low-stakes to maximize learning benefits and offset anxiety. When checks feel like high-stakes tests, anxiety interferes with retrieval. Frequent, informal opportunities such as exit tickets, brief partner explanations, quick whiteboard responses, create needed practice without stress.

Teachers should distinguish between fluency and understanding. Students may recall information smoothly, recognizing that a problem involves quadratic equations for example, without being able to solve it. Checking foundations means assessing not just quick recognition but whether students can apply, explain, and transfer to new contexts.

The temptation to race through material remains strong, but gaps in foundational knowledge create compounding barriers. Strategic scheduling of spaced retrieval practice transforms the relationship between time and learning: investing time in consolidation accelerates long-term progress. When key ideas are secure through properly spaced practice, subsequent learning proceeds with greater confidence and minimal reteaching.

Suggested readings: Bjork & Bjork (1992); Cepeda et al. (2006); Karpicke (2012); Dunlosky et al. (2013).

6.
Model Expert Thinking

Students do not always understand the reasoning processes that lead to successful performance. Making expert thinking visible helps them become better learners.

Research Findings

One of the most effective ways to help students learn is to show them how experts think. Research on cognitive apprenticeship and modeling demonstrates that learners benefit when teachers articulate the mental steps behind successful performance. Novices often see only outcomes such as a solved problem, a finished essay, a completed experiment, without actually understanding the reasoning that produced them.

However, making expert thinking visible requires more than thinking aloud; it requires designing instruction that systematically reveals the logical structure of concepts. As Engelmann and Carnine demonstrated, a lot of student learning follows predictable patterns when instruction is properly designed. Their work reveals an important dynamic for meeting the needs of struggling students: capable students often overcome poorly designed instruction through their own cognitive resources, creating the illusion that teaching works when it actually works only for those who need it least. Meanwhile, struggling students require precise, systematic guidance to form accurate concepts.

The key insight is that students induce general principles from specific instances through a logical process. When this process is ambiguous, in other words when examples allow multiple interpretations, some students will inevitably learn the wrong pattern. This is not a failure of intelligence but a predictable consequence of unclear instruction. As Engelmann and Carnine put it: "If kids mislearn, the fault is in the design, not the learner."

Effective modeling therefore requires what they call "faultless communication": designing sequences of examples and explanations that make expert thinking not just visible but unambiguous. This means controlling what varies and what stays constant across examples, signalling explicitly what students should attend to, and using systematic variation to reveal the boundaries and structure of concepts.

In the classroom

Making expert thinking visible begins with thinking aloud as teachers work through tasks. For instance, when solving a word problem, a teacher might say: ″First, I identify what the question asks. I see it wants the total cost, so I know I′ll need to add or multiply. The word ′each′ tells me I need to multiply. Before calculating, I′ll estimate: $12 is close to $10, and 10 times 3 is 30, so my answer should be close to 30 but a bit more. Now I′ll calculate: 3 times 12 is 36. That matches my estimate, so I′m confident.″

However, verbal modelling must be paired with systematic example design. When teaching concepts, teachers should show both examples and non-examples to establish clear boundaries. Students don′t just learn what something is; they learn what it is versus what it isn′t. A student who only sees triangles never learns what makes them triangular. Show triangles alongside squares and circles labelled ″not triangle,″ and the defining features crystallize.

The order and selection of examples matter profoundly. Teachers should keep everything constant except the one feature they want students to notice. Teaching ″bigger″? Use the same two objects in the same position; just change which is larger. Don′t vary color, shape, or location simultaneously, or students might form incorrect rules about those irrelevant features. Show three red circles to teach ″red,″ and some students will learn ″circular″ instead because both features are present in all examples.

Examples need explicit signals. Teachers must tell students what to attend to rather than assuming they′ll notice the right features. ″Notice how all triangles have three straight sides and three corners, but the size and angle don′t matter—this tiny one and this stretched one are both triangles.″ Without such guidance, students have no way of knowing which features are essential and which are incidental.

Systematic variation reveals concept boundaries while maintaining logical coherence. Teaching ″bird″? Show robins, eagles, penguins, and ostriches, but in an order that reveals flight is variable while feathers are constant. Begin with typical flying birds, then introduce flightless species to show wings don′t define the category. Random order will teach random concepts.

Teachers should also design minimal sets of examples that create maximum generalization. More examples aren′t better; the right examples are better. Teaching ″democracy″? Show cases that systematically contrast: people vote (versus dictatorships), leaders can be removed (versus autocracies), multiple parties compete (versus one-party states). Three well-chosen contrasts teach more than dozens of similar cases.

Different concept types demand different approaches. Teaching ″mammal″ needs boundary examples to establish defining features. Teaching long division needs step-by-step procedures. Teachers match their modelling method to concept structure rather than using one approach for everything.

Suggested readings: Collins, Brown & Newman (1989); Rosenshine (2012); Engelmann & Carnine (2016).

7.
Design Diagnostic Tasks

Well-designed assessment tasks reveal how students are thinking, not just what they recall, enabling teachers to adapt instruction with precision.

Research Findings

Not all assessment reveals understanding. A correct answer can mask confusion, and an incorrect one may reflect a partial grasp of complex ideas rather than complete misunderstanding. Responsive teaching relies on tasks that expose how students are thinking, not just what they can recall. Such tasks provide the evidence teachers need to adapt instruction with precision.

Effective formative assessment — the ongoing process of gathering evidence about student learning to inform teaching — begins with purposeful design. Tasks should be diagnostic: they should generate information about students' reasoning rather than simply their outcomes. This requires moving beyond questions that can be answered through memorization to questions that require explanation, application, or evaluation.

However, a critical insight from research on concept formation reveals that many assessments measure recognition rather than understanding. If students are tested only on the same examples used during instruction, they may succeed by remembering those specific instances without grasping the underlying concept. A student who can identify the three triangles shown in class but fails with a new triangle hasn't learned "triangle"; they've learned "those three shapes." Genuine understanding emerges when students can apply concepts confidently to novel examples they've never encountered.

This distinction matters profoundly. Assessment must test boundaries and transfer, not just rote recall. Can students distinguish examples from non-examples? Can they recognize concepts in new contexts? Can they explain why something fits or doesn't fit a category? These questions reveal whether students have formed accurate, generalizable concepts or merely memorized surface features.

It's also important to say that assessment also functions as a learning event, not just a measurement event. When students retrieve information and explain their reasoning, they engage in the kind of active processing that strengthens memory and deepens understanding. However, this benefit depends on keeping assessment low-stakes. When every check feels like high-stakes testing, anxiety interferes with the very learning that assessment should promote.

In the classroom

Diagnostic tasks take multiple forms, each revealing different aspects of understanding. Multiple-choice questions, often dismissed as superficial, become highly diagnostic when distractors represent common misconceptions. Offering 0.5 and 0.50 as different options when teaching decimals reveals whether students understand equivalence. Analyzing which wrong answers students choose provides specific information about systematic errors.

Open-ended prompts that require explanation push students beyond recall. Instead of ″What is photosynthesis?″ teachers ask ″Why do plants need both light and carbon dioxide?″ or ″What would happen to a plant kept in complete darkness? And why?″ These questions require demonstrating understanding of relationships and causation, not just reciting definitions.

Transfer tasks test whether students can apply concepts to genuinely novel situations. After teaching about triangles using specific examples, present shapes students have never seen and ask them to classify and justify. After teaching about democracy using historical cases, present a contemporary situation and ask whether it represents democratic principles. If students cannot transfer to new contexts, they haven′t achieved understanding regardless of how well they performed on familiar material.

Error analysis tasks can be particularly diagnostic. Present work samples containing mistakes and ask students to find and correct them, explaining what went wrong. This reveals whether students can recognize correct and incorrect applications; a higher level of understanding than simply producing correct answers themselves.

Short written reflections provide insight into metacognitive awareness. Exit tickets asking ″What was most challenging today?″ or ″Explain this concept to someone who wasn′t in class″ reveal not just what students know but their awareness of their own understanding.

The timing and stakes of diagnostic tasks matter. Brief checks during lessons allow immediate adjustment. If most students struggle, reteach immediately using a different approach. If only a few struggle, provide targeted support. End-of-lesson checks inform next-day planning. Keeping these checks frequent and low-stakes ensures students view them as learning opportunities rather than threats.

Designing diagnostic tasks also benefits students directly. When asked to explain thinking, students engage in retrieval and elaboration that strengthen memory. When they analyze errors or compare solutions, they develop metacognitive awareness. Assessment becomes inseparable from instruction; every task both reveals understanding and deepens it.

Suggested readings: Black & Wiliam (1998); Wiliam (2009); Engelmann & Carnine (2016); Karpicke (2012).

8.
Balance Support and Independence

Temporary support that gradually decreases as student competence increases builds learner independence over time.

Research Findings

Effective instruction guides students toward independence. Scaffolding provides necessary support at early stages of learning, but if it remains too long it can prevent autonomy and transfer. Research on the gradual release of responsibility by the teacher, gradually transferring responsibility to students as the teacher steps back, explains why timing matters: the optimal level of support decreases as competence increases.

The concept of scaffolding, introduced by Wood, Bruner, and Ross in 1976, proposed that tutors should adjust support based on learner performance. However, recent large-scale replication research reveals that this relationship is more complex than originally understood. A 2025 study involving 285 children found that simply following a rule of "more help after failure, less after success" did not improve learning outcomes. This suggests that effective scaffolding requires sophisticated judgment rather than mechanical application of rules.

The challenge lies in distinguishing "help" from "control." Some struggles and mistakes are not failures but mechanisms of learning itself. Conversely, well-intended assistance can function as control, removing the productive difficulty necessary for development. When support eliminates all challenge, it may feel helpful but undermines independence. Help enables learners to achieve what they cannot yet do alone; control takes over completely.

True scaffolding addresses missing prerequisites rather than simplifying current tasks. When students struggle, the instinct is often to make work easier. However, research on instructional design shows this can obscure the real problem. Effective scaffolding builds capacity by identifying and teaching foundational knowledge students lack. This has profound implications for equity: capable students often succeed despite gaps; struggling students require explicit instruction in these foundations.

In the classroom

Responsive teachers monitor the balance between support and independence continually, but this requires judgment rather than formula. Effective scaffolding involves "leading by following"; remaining attentive to learners but also allowing students opportunities to make errors within a set of boundaries when they can see examples and non-examples.

Early in a unit, teachers may model strategies explicitly, provide sentence starters, or structure tasks clearly. As students gain fluency, supports are reduced. This progression mirrors: "I do" (demonstration), "we do" (guided practice), "you do" (independent application). During guided practice, teachers observe responses and provide feedback before errors become entrenched.

When students struggle with current work, teachers should diagnose rather than simplify. A student failing at algebraic equations might lack understanding of arithmetic equations. The solution is not easier algebra but explicit teaching of the missing foundation. Teachers work backward through prerequisites, addressing actual gaps.

Timing is crucial but cannot be reduced to rules. Different learners need different amounts of time to struggle productively. Teachers must make moment-to-moment judgments: Has this student had enough time to work through difficulty? Is this a desirable difficulty or frustration? These decisions require attending closely to individual learners.

Scaffolding can be faded through several techniques. Instead of fully worked examples, teachers offer partially completed examples where students fill in missing steps. Instead of explicit instructions, they provide general guidelines students must interpret. Instead of answering questions directly, they respond with guiding questions: "What have you tried?"

Teachers should explicitly teach metacognitive strategies: elaboration, self-explanation, self-questioning ("Can I do this independently?"), and recognizing when to seek help. These skills enable students to regulate their own learning and recognize when they can work independently.

The ultimate purpose of scaffolding is to make itself unnecessary. The point is that it's temporary. Over time, teachers should see students becoming progressively more independent, taking initiative, self-correcting, seeking resources when stuck. This growing autonomy signals that scaffolding has achieved its purpose: not to make tasks easier, but to make students more capable.

Suggested readings: Pearson & Gallagher (1983); Wood, Bruner & Ross (1976); Smit et al. (2025); Engelmann & Carnine (2016).

9.
Maximise Student Participation

When all students contribute actively, teachers can gather evidence from everyone and make instructional decisions that serve the whole class.

Research Findings

For teachers to respond effectively, they need information from as many students as possible. If only a few voices are heard, feedback is partial and instruction may favour the most confident students. Research on classroom discourse shows that equitable engagement increases both learning outcomes and accuracy of teacher judgement.

However, participation must serve learning, not just measurement. Research on retrieval practice shows that recalling information from memory strengthens it. When students actively retrieve and articulate ideas, they engage in processing that promotes learning. Participation activities function as learning events, not merely assessment events.

The effectiveness of participation depends on both frequency and stakes. Traditional recitation patterns (teacher asks, one student responds, teacher evaluates) result in low participation ratios. Frequent, low-stakes opportunities for all students to participate create better conditions for learning than occasional high-stakes responses from volunteers.

Beyond mechanics, engagement must be cognitive as well as behavioural. When tasks require genuine thinking from everyone, teachers gain clearer pictures of collective understanding. Questions that require explanation, prediction, or evaluation encourage deeper processing than simple recall.

In the classroom

Simple strategies can dramatically increase participation. Mini-whiteboards allow all students to display responses simultaneously. After posing a question, teachers allow thinking time, then ask everyone to write answers and hold up boards. Teachers quickly scan responses to gauge understanding and decide whether to move forward.

The process of ‘Cold-calling’, where teachers select respondents rather than relying on volunteers, ensures wider contribution. To avoid anxiety, teachers can provide thinking time before calling on anyone, allow students to confer with partners if stuck, or explicitly frame it as hearing from everyone rather than testing knowledge.

Brief partner discussions guarantee that even quieter students engage verbally. The structure is simple: the teacher poses a question, students think individually, turn to partners to share, then teachers call on pairs to share with the class. This ensures every student thinks about every question and articulates ideas at least once.

"Think-pair-share" can be enhanced by adding writing: think-write-pair-share. Having students briefly jot down ideas before discussing ensures all have something to contribute and prevents faster thinkers from dominating. This also provides teachers with written evidence when they circulate.

These participation structures work best when kept low-stakes and framed as learning opportunities. When students associate retrieval with high-stakes assessment and fear of failure, anxiety can create negative feedback loops. Teachers should frame participation as ″having a go″ without judgment; making it safe to think aloud, make mistakes, and revise understanding.

The questions themselves matter. ″What is photosynthesis?″ requires only recall. ″Why do plants need both light and carbon dioxide?″ requires understanding relationships. ″What would happen to a plant kept in complete darkness, and why?″ requires application. Questions requiring explanation reveal depth of comprehension and engage students in elaborative processing that strengthens learning.

Inclusive participation also supports equity. In many classrooms, quiet or marginalized students are excluded from feedback loops. Students from some cultural backgrounds may be less likely to volunteer, not from lack of understanding but because cultural norms discourage self-promotion. Students with processing differences may need more time to formulate responses than rapid-fire questioning allows.

By designing routines that require all learners to contribute, with sufficient thinking time, low-stakes formats, and respectful listening, teachers ensure that instructional adjustments reflect every student′s understanding, not just the most vocal. This is both pedagogically sound and ethically important.

Suggested readings: Nystrand (1997); Karpicke (2012); Dunlosky et al. (2013).

10.
Provide Corrective Feedback

Feedback that identifies specific misunderstandings and provides clear guidance helps students close the gap between current and desired understanding.

Research Findings

Feedback is among the most powerful influences on achievement, but its effects depend on how it is used. Research shows that feedback focused only on grades or performance relative to peers can undermine motivation, while feedback focused on the task and how to improve promotes learning.

The distinction between feedback and corrective feedback matters. Simple feedback provides knowledge of results, merely whether an answer is right or wrong. Corrective feedback leads to correction of errors and misunderstandings. It identifies the specific misunderstanding, error in reasoning, or procedural mistake that led to the error, and provides guidance for improvement.

Responsive teaching treats corrective feedback as guidance; information that helps students close the gap between current and desired understanding. However, feedback also serves a reciprocal function: teachers learn from students' responses and adjust instruction accordingly. Each student response provides data about what to revisit, extend, or accelerate.

The manner and timing of feedback matter. Immediate feedback is useful for building fluency with factual or procedural knowledge. Quick confirmation or correction helps solidify correct responses. However, delayed feedback can promote deeper reflection on complex tasks. When students have worked through multi-step problems, receiving feedback after completing their best effort encourages grappling with challenges before seeing solutions.

Feedback is most effective when students have opportunities to act on it. Building in time for students to revise work, try again after guidance, or apply feedback to new tasks ensures that feedback serves its learning purpose.

In the classroom

Instead of simply marking answers wrong, corrective feedback identifies the misunderstanding that led to the error. In mathematics, when a student incorrectly adds 34 + 28 by treating each digit separately (3 + 2 = 5, 4 + 8 = 12, answer 512), feedback addresses the underlying misunderstanding about place value and regrouping.

In writing, corrective feedback might demonstrate how sentence structure affects clarity. Rather than marking "unclear," the teacher shows: "This sentence connects too many ideas with 'and', so let's break it into two sentences to clarify relationships." This provides specific guidance rather than vague critique.

In science, feedback could trace an incorrect conclusion back to faulty reasoning. When a student predicts heavier objects fall faster, feedback might involve revisiting gravity and air resistance concepts, conducting demonstrations, and helping revise mental models.

The language of feedback matters. Feedback focused on task and process ("Your explanation would be clearer with an example") promotes learning better than feedback focused on the person ("You're not good at explaining"). Feedback emphasizing growth ("You've improved your use of evidence") is more motivating than feedback emphasizing fixed traits.

Teachers should be strategic about feedback quantity. Overwhelming students with extensive feedback on every aspect can be counterproductive. Focusing on one or two key areas for improvement, chosen based on student readiness and curricular priorities, is typically more effective.

Feedback should be timely enough to be useful. For daily work, this means quick verbal feedback during lessons or brief written comments on assignments returned the next day. For substantial work like essays or projects, feedback should arrive with sufficient time for revision before final submission.

Teachers should make feedback opportunities low-stakes when possible. When every piece of feedback feels like high-stakes evaluation, students may become anxious and defensive rather than receptive to guidance. Frequent, informal feedback that frames errors as natural parts of learning creates better conditions for improvement.

Finally, feedback informs planning. Patterns of similar errors across students signal need for reteaching. Consistent success indicates readiness for greater challenge. Partial understanding suggests next steps. Teaching becomes a continuous cycle: evidence from students shapes instruction, instruction generates new evidence, and that evidence refines teaching further.

Corrective feedback thus closes the learning loop for students while opening the planning loop for teachers, making instruction progressively more attuned to learner needs.

Suggested readings: Hattie & Timperley (2007); Shute (2008); Black & Wiliam (1998).

Conclusion

Responsive teaching rests on a fundamental insight about the nature of learning itself: learning is recursive, not linear. Students do not simply progress from not knowing to knowing in a single, predictable path. Instead, understanding develops gradually, incompletely, and often deceptively. What appears to be mastery during initial instruction can reveal itself as partial understanding or systematic misconception when students encounter the same content in new contexts or attempt to integrate it with subsequent learning. This is why responsive teaching matters: misunderstandings frequently emerge after learning is judged to have taken place, requiring teachers to remain vigilant and adaptive long after initial instruction concludes.

The ten principles outlined in this booklet address this recursive nature. Checking understanding regularly recognizes that apparent comprehension may not indicate durable learning. Using misconceptions as opportunities acknowledges that errors often reflect well-organized but incorrect mental models beneath surface performance. Securing foundations through spaced retrieval addresses the reality that initial fluency can mask fragile understanding. These principles are interconnected: connecting to prior knowledge enables accurate diagnosis, recognizing conceptual structures influences example selection, and each principle reinforces the others.

The research summarized here reveals that effective teaching requires sophisticated professional judgment rather than mechanical application of rules. Recent large-scale research demonstrates that following rigid formulas about when to provide support offers no measurable benefit. Instead, effective scaffolding requires distinguishing productive struggle from unproductive confusion, help that enables from control that takes over. Similarly, checking understanding effectively means designing tasks that reveal how students think, not just what they recall.

The evidence converges on key insights. First, capable students often overcome poor instructional design through their own cognitive resources, creating the illusion that teaching works when it primarily benefits those who need help least. Responsive teaching therefore has profound equity implications: by attending systematically to all students' understanding and adjusting accordingly, teachers ensure learning opportunities genuinely serve all learners.

Second, many mechanisms producing durable learning are counterintuitive. Temporary forgetting strengthens memory through effortful retrieval. Difficulty that feels uncomfortable often produces better retention than ease that feels productive. Teachers must sometimes sit with the discomfort of seeing students struggle, trusting that productive difficulty serves learning.

Third, effective teaching requires balancing multiple demands: providing support while building independence, maintaining high expectations while adapting means, allowing productive struggle while preventing frustration. These balances require ongoing attention to evidence and willingness to adjust.

The principles presented here focus on fundamental aspects of formal schooling—how memory works, how concepts are formed, how misunderstandings develop—but their application must be adapted thoughtfully. What constitutes appropriate wait time, how to interpret student silence, which examples resonate: these decisions depend on cultural context and specific students.

Responsive teaching is therefore more than strategies. It is a professional stance characterized by systematic attention to evidence, willingness to adapt, and commitment to ensuring all students develop genuine understanding. It requires both expertise, recognizing patterns in student thinking and selecting appropriate responses, and humility, adjusting plans when students' needs diverge from expectations.

Because learning is recursive rather than linear, because misunderstandings emerge after instruction rather than only during it, teaching must be fundamentally responsive. When teachers listen carefully to learning and adapt with purpose and principle, they honor the reciprocal relationship defining education: teaching shapes learning, but learning must also shape teaching. This ongoing responsiveness represents not just effective practice but the essence of the teaching profession itself.

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Through his writing, speaking, and consultancy, he is committed to making complex research accessible and actionable for educators. Carl is also a member of the UNESCO IBE Science of Learning editorial board.

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