Teaching Methodology and Innovation for Secondary-School Teachers

A Practical, Zero-cost Manual for Equitable Teaching Using Board, Paper and Voice

by

José Manuel de Haro García

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About the Author

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Introduction
Teaching Better with What We Have

Teaching has always involved making decisions under constraints. Teachers must determine what is worth explaining, how to connect new ideas with what students already know, which activities deserve limited classroom time and how to recognise when learning has genuinely occurred. These decisions matter in every school. They become particularly consequential where classes are large, language proficiency varies and resources consist mainly of a board, paper and the teacher's voice.

This manual begins with a conviction that is both practical and ambitious: equitable teaching does not depend on expensive equipment, but on the quality of the opportunities students have to understand, practise, participate and receive useful feedback. Technology can expand these opportunities, but it cannot substitute for a clear learning objective, a well-chosen explanation or an informed decision about what students need next. A resource-constrained classroom is not a classroom without pedagogical possibilities.

The book is intended primarily for secondary-school teachers and teacher educators across subjects. It is also a working resource for school leadership teams supporting classroom improvement. Readers are not expected to adopt a fashionable method wholesale or abandon established practices. Instead, they are invited to examine the reasoning behind their teaching, preserve approaches

that work and test small changes where credible evidence suggests that improvement is possible.

From good intentions to observable learning

A lesson may feel successful because students are quiet, attentive or enthusiastic. Yet these signs alone cannot establish whether the intended learning has taken place. Students sometimes complete guided exercises successfully but cannot solve a related problem days later; they can repeat a definition without understanding its implications; or they appear reluctant to participate even when they have useful ideas. The book repeatedly returns to the distinction between what students visibly do and what they can later understand, retrieve and apply.

Evidence-informed teaching begins by asking what students need to learn and what kinds of evidence would demonstrate that learning. Research in cognitive psychology, motivation and educational assessment can inform this judgement. It does not, however, provide a universal recipe that works equally well for every student, subject and classroom. An instructional practice becomes valuable when a teacher can explain its purpose, judge its fit with the learners' starting point and examine the results rather than simply assume its effectiveness.

The science of learning is therefore treated as a guide to professional judgement. Findings about memory and retrieval, for example, help teachers design useful reviews; research on cognitive load suggests how to organise an unfamiliar explanation; and work on feedback provides criteria for helping students improve their next attempt. Each principle is accompanied by its

limits, because an evidence-informed approach must be capable of saying not only "this may help" but also "this may not be appropriate here".

Equity as a matter of instructional design

Equity is sometimes discussed as an abstract aspiration. In everyday teaching, however, it can be expressed through concrete questions. Who gets time to formulate an answer before the confident few speak? Which students understand the subject but struggle with the language of instruction? Does a complex assignment make unnecessary assumptions about access to devices or connectivity? Can the teacher gather meaningful evidence from a large group without collecting pages of additional paperwork?

The approaches in this manual seek to widen opportunities for participation and understanding while maintaining meaningful academic expectations. They include brief individual thinking time, structured discussion, careful vocabulary support, guided examples, low-stakes checks of understanding and opportunities to revise work. None requires lowering the intellectual demands of a subject. The intention is to remove avoidable barriers so that students can engage with those demands more successfully.

The phrase "board, paper and voice" is consequently more than a statement about equipment. It is a design constraint that encourages clarity and transferability. Every essential strategy should remain usable in a classroom without reliable internet, a projector or a personal device for each student. Where digital tools are available, they may be introduced when they demonstrably

serve the learning objective. The sequence is deliberate: establish the educational purpose first and select the tool second.

How the six modules fit together

The first module establishes a foundation in how learning works. It examines attention, prior knowledge, memory, cognitive load and emotion, and then develops practical principles for retrieval, spacing, interleaving, metacognition and transfer. The purpose is not to turn teachers into neuroscientists, but to help them recognise why apparently successful instruction sometimes produces fragile understanding and how better-designed practice can contribute to durable learning.

Module 2 turns these principles into methods and tools. It explores the teacher's role as a designer of learning experiences, a repertoire of accessible techniques and several active methodologies. Its central question is not whether an activity is labelled "active", but whether students undertake the relevant intellectual work. It also considers when direct instruction and guidance remain important, especially for beginners and for complex material.

Module 3 addresses motivation, classroom climate and engagement. Students' willingness to take part is affected by the meaning they attribute to a task, their perceived ability to improve and the way classroom relationships are organised. Teachers cannot control every influence on motivation, but they can design more predictable, supportive and appropriately demanding opportunities for participation. The module therefore focuses on specific classroom decisions rather than motivational slogans.

Module 4 places assessment inside teaching rather than solely at the end of it. It distinguishes formative from summative purposes and shows how questions, short written responses, rubrics, self-assessment and peer feedback can inform subsequent instruction. The emphasis is on evidence that leads to action: a useful assessment is one that changes what a teacher or student does next.

Module 5 introduces GIRO, an original framework for developing manageable teaching micro innovations. The method begins with a clearly defined educational problem, gains insight from reality, considers possible routes and converts a selected idea into an intervention that can be implemented and evaluated. GIRO is not presented as a guarantee of improved results. It is a disciplined process for making instructional decisions explicit, testable and open to revision. Examples drawn from teacher development illustrate the kinds of designs educators can generate, while distinguishing proposed interventions from independently demonstrated outcomes.

Module 6 examines artificial intelligence through a deliberately durable educational lens. As platforms and features change, the underlying questions remain. Which intellectual operations should the student carry out? When does assistance help, and when does it replace productive thinking? How should learners check the reliability of information? How can teachers assess independent understanding as well as assisted performance? By comparing consultation and advisory patterns of interaction, the module asks readers to judge the architecture of learning rather than become dependent on any product.

From reading to classroom action

This book is designed to be used, not merely read. The explanatory sections introduce research and concepts; short examples make the mechanisms easier to see; practical procedures translate them into choices a teacher can make tomorrow; and training activities invite participants to analyse, evaluate and redesign their own practice. End-of-module tasks extend beyond factual recall towards application, reasoned comparison and creation, in keeping with the revised taxonomy of educational objectives.

The concluding section and printable annexes support a modest but disciplined implementation cycle. Teachers select one issue that matters in their context, define an observable goal, choose a feasible adjustment and gather simple evidence over a short period. A peer-support group can then help them improve their designs, recognise unintended consequences and decide whether to retain, modify or abandon an intervention. The underlying principle is that professional learning is incomplete until it informs classroom decisions.

The examples reflect common challenges reported by teachers working in resource-constrained secondary education, including large classes, varied language proficiency, unequal participation, a need for actionable feedback and the difficulty of transferring classroom knowledge to daily life. Some of the preparatory work was informed by a preliminary teacher-needs assessment in Rwanda and by professional-development experience with university faculty. These sources shaped the choice of problems; they do not mean that one setting represents every school or that the approaches have already been proven effective in every context.

Readers should therefore adapt, not imitate. A routine that helps students explain a science concept may require different wording and different checks in literature or mathematics. Likewise, a participation technique suited to one class may need adjustment where classroom relationships, language demands or students' prior knowledge differ. The essential common denominator is the teacher's capacity to make a reasoned choice, explain it and look for evidence of its consequences.

A realistic ambition

Educational change is often described in the language of transformation. In practice, improvement may begin with something much smaller: a question that reveals a misconception, a worked example that clarifies a procedure, a review distributed across several lessons, a safer way to invite tentative answers or a feedback comment that tells a student what to do next. Such changes are not automatically innovations merely because they are new to a particular teacher. They become meaningful when they address an identified learning need and are examined with appropriate evidence.

The ambition of this manual is therefore modest in scale and demanding in substance. It invites teachers to use the resources already available, to treat their expertise as an asset, to question attractive but unsupported claims and to regard improvement as a continuing process of informed experimentation. Better teaching does not require perfect conditions. It requires clear purposes, sound judgement and a willingness to learn from what happens in the classroom.

Module 0
How to Use This Manual

A practical route from reading to classroom improvement

Module objectives

By the end of this module, teachers will be able to understand the audience, purpose and limits of this manual; to navigate the six modules, the integrated activities and the printable toolkit; and to use the book either as a guided professional-development programme or as a self-directed reference. They will also be able to plan an achievable classroom trial, collect evidence of learning and refine the intervention, and to organise peer support and protect equitable participation when resources are scarce.

What this manual is for and who it is for

This book is a working manual for secondary-school teachers, teacher educators, school leaders and facilitators of professional development. It is designed for educators who wish to strengthen their practice by connecting evidence about learning with decisions they can make in ordinary classrooms. It does not assume access to a learning management system, a projector, devices for every student or uninterrupted connectivity. Its essential tools are the board, paper, voice and thoughtful interactions among teachers and learners.

The zero-cost principle is a design commitment, not a claim that teaching requires no resources. Teachers invest time, expertise and

emotional energy; school systems must still provide fair working conditions and appropriate support. Zero-cost means that the core activities can be implemented without purchasing new software, equipment or commercial materials. Whenever digital tools or artificial intelligence appear, they are optional and accompanied by an offline alternative.

The manual is particularly relevant to large classrooms, diverse levels of prior knowledge and multilingual learning environments. It has been informed by a needs assessment for a teacher-development initiative at APEKI Tumba in Rwanda. Twenty-five respondents, from an estimated school population of around seventy teachers and leaders, reported priorities including classroom climate, effective feedback, practical transfer of learning and collaboration. Those results guide the choice of examples; they are a context-specific diagnostic sample, not proof that the same priorities apply to every school.

The six modules are written to be internationally adaptable. Examples drawn from science, mathematics, history, languages and community situations should be adjusted to local curricula, cultural practices, the students' ages and the actual resources available. Teachers are encouraged to change the context while preserving the learning purpose.

The approach: Experience, explain, apply and evaluate

The central principle is that professional development should change practice rather than simply add terminology to teachers' vocabulary. Reading about retrieval practice is not equivalent to experiencing a retrieval task. Understanding the logic of a rubric is

not equivalent to designing one that students can use. For that reason, the book combines research-informed explanations, worked examples, short activities, opportunities for critique and a concrete implementation commitment.

The learning progression is inspired by the revised Bloom's taxonomy: participants first explain a principle, then apply it, analyse a classroom problem, evaluate alternatives and create an intervention. These operations are complementary; they do not need to occur in a rigid order. Some teachers may begin by analysing a problem they already know well and return to the scientific explanation to test their assumptions.

Teachers should treat examples as models for adaptation rather than scripts to reproduce word for word. An active technique is not automatically effective because students appear busy. The guiding question remains: what are students expected to learn, which cognitive processes will the activity elicit, and what evidence will show that learning has occurred?

A second principle is professional agency. Teachers work within real constraints that cannot always be changed immediately. This manual focuses on decisions within their influence, without implying that systemic barriers can be solved through individual enthusiasm alone. Where a problem exceeds the teacher's control, it should be documented and brought to the school leadership team.

How the six modules fit together

The sequence moves from an explanation of learning towards instructional design and improvement. Each module can stand

alone, but the relationships between modules are central to the book's purpose. Table 1 summarises the core question that each module addresses and the practical result it is intended to produce.

Table 1. The six modules: Core questions and practical results

Module	Core question	Practical result
1 · How the Brain Learns	Why do students remember, misunderstand or forget?	A lesson revised to support understanding, retention and transfer.
2 · Teaching and Learning Methods	Which approach best fits this objective and these learners?	A minimum viable active lesson.
3 · Motivation and Engagement	What helps students see value, participate and persist?	A targeted engagement or classroom-climate routine.
4 · Assessment for Learning	What evidence is needed, and what should change next?	A quick check, useful feedback and a revision opportunity.
5 · GIRO Method	How can a classroom concern become a manageable test?	A documented micro innovation and action plan.
6 · Artificial Intelligence	When does AI assist learning, and when does it replace student thinking?	A responsible AI-use design with an offline equivalent.

The chapter sequence is not a list of fashionable techniques. Together, the modules invite teachers to work through a professional reasoning cycle: understand the problem, choose a strategy, make learning visible, evaluate what happens and improve the design.

How to read and use each module

Each module begins with objectives and an explanation of its scientific and pedagogical foundations. Worked examples make abstract principles concrete, and "Putting it into practice" sections describe feasible implementation steps. Training activities then invite teachers to practise, challenge or redesign an approach. The chapter closes with key ideas, questions progressing towards analysis and evaluation, and terminology and references for further study.

Not every activity is intended to be completed in a single course. Facilitators should select a small number that fit the participants' needs and available time. A good selection gives teachers an experience of the method, opportunities to discuss its limits and enough time to adapt it to a real lesson. Completing all exercises superficially would contradict the book's emphasis on meaningful learning.

The general annexes contain printable templates that can be photocopied, copied by hand or reproduced on a board. Some resources serve the teacher as planning tools; others can be given directly to students. The multiple-choice and short-answer questions can support self-checks, group discussion or formal training assessment. The answer key is intended for facilitators, who should decide when to distribute it.

Using the manual in an intensive training programme

An intensive ten-day course is one possible delivery format, not a requirement. The sequence in Table 2 illustrates how to combine explanation, modelling, guided application and time for the design

of a classroom intervention. Adjust the number and length of sessions to local timetables, language needs and teacher workload. The aim is to achieve a usable product, not to cover a prescribed number of slides.

Table 2. An illustrative ten-day training sequence

Training period	**Focus**	**Participant output**
Days 1–2	Learning processes and practical lesson design (Modules 1–2)	A revised lesson with one explicit learning check.
Days 3–4	Motivation, classroom climate and formative assessment (Modules 3–4)	A participation strategy and a feedback tool.
Days 5–7	GIRO: goal, insight from reality, possible routes and obligation to act (Module 5)	A one-page micro innovation and measurement plan.
Days 8–9	Responsible use of AI or offline alternatives (Module 6); peer review	A tested prompt or offline equivalent and an improved project.
Day 10	Presentation, assessment and transfer planning	A 30-day action plan and a peer-support commitment.

A typical workshop segment can follow a predictable sequence: a short stimulus or problem, a clear explanation, facilitator modelling, independent or small-group design, structured peer feedback and a concrete adaptation for the next teaching opportunity. A useful operating principle is to protect more time for practice and feedback than for uninterrupted presentation, while responding flexibly to the subject matter and participants' prior knowledge.

Training in English may need additional support when it is not every participant's strongest professional language. Facilitators can pre-teach essential terms, offer a short glossary, slow down at conceptually demanding points and invite teachers to rehearse an idea with a partner. Language assistance should support, not dilute, the intellectual demands of the activity.

An alternative: Short online or blended training

When travel or face-to-face meetings are not possible, the same learning outcomes can be pursued through shorter online encounters combined with local work. One illustrative model uses five live workshops of approximately 90 minutes, separated by self-directed practice, with local facilitators supporting small groups where feasible. Teachers still design and test a classroom improvement, and the programme retains its 30-, 60- and 90-day follow-up logic.

Connectivity constraints should influence the design from the beginning. Provide lightweight documents rather than mandatory video, minimise large downloads, permit asynchronous submissions and establish a fallback communication channel. Where online access is unreliable, the core activities can be completed on paper and discussed locally. The presence of technology should not determine who can participate meaningfully.

Using the manual as a professional reference

Teachers do not need to reread the entire manual whenever a classroom challenge emerges, because the book can also function as a diagnostic reference. A concern about forgetting points

towards Module 1; passive participation towards Modules 2 and 3; unhelpful feedback towards Module 4; an unresolved recurring problem towards Module 5; and uncertainty about a generative AI tool towards Module 6.

A practical reading routine has four moves: identify one observable problem, consult the most relevant section, select one feasible adjustment and specify what evidence would count as improvement. Record the decision on one page. At the next teaching opportunity, make the change and compare what happens with the initial evidence. This keeps professional learning manageable.

For example, "my students do not participate" is too broad to evaluate. A narrower observation could be: "during whole-class questioning, fewer than six of forty-eight students give oral answers." A teacher could introduce one minute of individual thinking followed by pair rehearsal and then monitor the proportion of students attempting a written response and the quality of their explanations. The numbers are illustrative, not findings from the Rwanda needs assessment.

From reading to a 30-day classroom trial

The 30-day trial turns educational intentions into a small, observable test. It is not a formal experiment by default, and it should not be presented as causal evidence merely because a classroom indicator improves. Its purpose is to make teacher reflection more systematic and to guide the next practical decision. Table 3 sets out the question the teacher asks at each stage of the trial and the minimum evidence needed to answer it.

Table 3. Stages of the 30-day classroom trial

Stage	Teacher question	Minimum evidence
Before the trial	What precise problem do I observe, and for whom?	A baseline response, work sample or participation record.
Design	Which small change is feasible and why might it help?	One specific action linked to a learning principle.
Implementation	Did I deliver the change as planned?	A brief implementation note and any adjustments.
Review	What changed in student learning or participation?	Comparable evidence, plus limitations and alternative explanations.
Next decision	Keep, adapt, repeat or discontinue?	A decision with a reason and a follow-up date.

Collect only information that is educationally necessary and protect students' privacy. Avoid including identifiable student work, health information or sensitive classroom descriptions in unapproved external services. Ask for permission when classroom observation or sharing student materials requires it. Ensure that participants understand the difference between internal improvement, programme evaluation and formal research.

Peer support: Making improvement sustainable

Teaching development becomes more resilient when educators can discuss problems, challenge assumptions and share feedback. The book therefore recommends small peer-support groups rather than dependence on a single external facilitator. Even a thirty-

minute monthly meeting can provide an opportunity to revisit commitments and examine emerging evidence, provided the discussion remains focused.

A simple meeting protocol allows five minutes to restate the classroom problem, ten minutes to present evidence, ten minutes for clarification and alternative explanations, and five minutes to agree on the next step. Participants should avoid turning the meeting into an unstructured exchange of complaints or into a competition to demonstrate success. An intervention that did not produce the expected change can still generate useful professional learning.

Facilitators may use the GIRO framework to keep conversations practical: define the goal, gain insight from reality, consider possible routes and agree on the obligation to act. Before sharing results with other schools, teachers should document context and limitations so that an apparently successful idea is not presented as a universal recipe.

Assessing professional learning

The assessment resources in this manual serve different purposes. A multiple-choice item can check understanding of a concept; a short-answer question can reveal reasoning; a case analysis can test whether the teacher recognises relevant constraints; and a GIRO project can demonstrate capacity to design an improvement. No single instrument captures every aspect of professional learning.

The strongest evidence of transfer comes from classroom application and subsequent reflection. Teachers should compare the quality of work produced during training with the quality of

their later instructional decisions. When feasible, they should also check whether students can understand, retrieve and apply the intended knowledge after a delay, rather than reporting only that an activity was completed.

Assessments can be low stakes. Feedback should identify what is persuasive, what is unsupported and what could be improved. In evaluating a micro innovation, the central criteria are the relevance of the problem, the coherence of the proposed response, feasibility, attention to inclusion and the quality of the evidence plan – not novelty for its own sake.

Getting started: A ten-minute orientation activity

Before reading the first module, ask participants to describe one recurring classroom challenge and one piece of evidence that suggests it exists. In pairs, they distinguish what they have observed from what they assume is causing it. They then write one question they hope the manual will help them answer. Keep the responses and revisit them during the final workshop or after the 30-day trial.

This short activity establishes the book's central working habit: move from general concern to observable evidence, from technique selection to deliberate design, and from good intentions to reviewable results.

Key ideas

This manual should be used as a guide to professional decisions, not as a compulsory checklist of techniques. Its examples are meant to be adapted to the local curriculum, learners and resources

while preserving the learning objective, and its assessment tools and annexes are best treated as reusable supports for formative professional learning.

In practice, this means choosing one feasible classroom trial, specifying meaningful evidence and revisiting the decision after implementation. Progress is then sustained through peer feedback and careful attention to the limits of what classroom evidence can establish.

Module 1
How the Brain Learns

Evidence-based principles for secondary classrooms

Module objectives

By the end of this module, teachers will be able to explain how attention, prior knowledge, working memory, emotion and long-term memory interact in learning; to design manageable, inclusive instruction for large classrooms with limited resources; to use retrieval, spacing, interleaving and metacognitive routines appropriately; to distinguish immediate performance, durable learning and transfer; and to analyse and evaluate instructional decisions using scientific evidence.

What learning is: Memory, attention and emotion

Understanding learning requires distinguishing initial exposure, immediate performance, and durable changes in the knowledge that learners can use. A student can reproduce a solution while a worked example remains on the board yet fail to solve a similar task three days later. The original demonstration may have supported immediate performance without producing sufficiently accessible independent knowledge. This distinction helps explain why teachers need evidence collected both during instruction and after a delay (Soderstrom & Bjork, 2015).

Information processing is not a mechanical sequence of three isolated boxes. Attention selects and prioritises some information;

working memory maintains and manipulates information; and existing knowledge in long-term memory shapes what the learner notices and understands. Encoding, consolidation and retrieval interact with previous knowledge, practice and feedback. Sousa (2017) offers a useful teaching-oriented account of these relationships, while cognitive research cautions against reducing them to a single linear description of brain activity.

Consider a class learning about soil erosion. One teacher asks pupils to copy a definition; another asks them why rainfall damages an exposed hillside more than a vegetated one, then uses their explanations to introduce runoff and soil stability. Both may deliver accurate content. The second more deliberately guides students to think about causal relationships. The contrast illustrates a question raised by Willingham (2009): what are students thinking about during the activity?

Emotion shapes attention, perceived relevance, willingness to attempt challenging tasks and persistence. Immordino-Yang and Damasio (2007) emphasise connections between affective and social processes and reasoning. This does not imply that every memorable lesson must be entertaining: a fascinating anecdote that distracts from the learning objective may be counterproductive. Equally, productive challenge may involve uncertainty or temporary frustration. The teacher's task is to combine intellectually useful effort with sufficient structure and support.

In a class of fifty, these ideas have practical consequences. A short individual response followed by paired explanation can reveal students' thinking more effectively than asking whether everyone

has understood. At the end of the lesson, a new question can test application; at the start of a later lesson, another question can check retention. Visible attention alone cannot establish learning.

An initial caveat is needed: between the neuroscience laboratory and the classroom there is a bridge to cross with caution. Not every finding about neurons is a teaching recipe. We will therefore rely mostly on cognitive psychology (the study of how memory and attention work), the level best tested for classroom practice. On that basis, the module ends by dismantling the neuromyths that circulate in staff rooms worldwide.

From a cognitive standpoint, learning is producing a durable change in long-term memory: something we did not know – or did not know how to do – and that, after some time, we can retrieve and use. If it has evaporated by the next day, there was no learning: there was activity. Daniel Willingham sums it up in a phrase worth keeping in mind:

> "Memory is the residue of thought." – Daniel Willingham (2009)

That is, we remember what we think about. So, the first question when designing a lesson is not "What am I going to tell them?" but "What are my students going to think about?"

The same principle can be seen across subjects. In History, a bare date ("1789") means nothing; within the story of why the French Revolution broke out, the mind processes and retains it. In Physics, memorising $F = m \cdot a$ is not learning; understanding why a heavier cart needs more force for the same acceleration is. In Literature, a

line of verse sticks when the student thinks about its meaning or emotion, not when it is repeated mechanically.

This thinking rests on three pillars that work together (Atkinson & Shiffrin, 1968). Attention is the gateway, since only what we attend to is processed; memory is the workshop where information is handled and, with luck, consolidated; and emotion regulates what is worth remembering and how strongly. Without attention nothing enters; without memory nothing remains; without the right emotion, we neither attend well nor consolidate.

Figure 1 summarises the central argument of this module: durable learning is built when teaching connects prior knowledge with meaningful attention, manageable cognitive processing, supportive classroom conditions, repeated retrieval and opportunities for transfer.

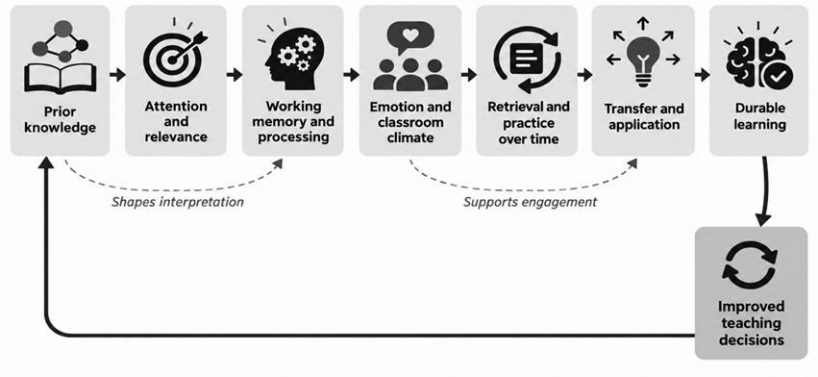

Figure 1. How learning becomes durable

Durable learning emerges from the interaction between prior knowledge, attention, working-memory processing, emotion and classroom climate, retrieval and practice over time, and