



Content	Do This/Remember This
<p>Introduction: Learning occurs in the learner’s brain, result of what learner does + thinks, T’s job = provide optimal circumstances, teaching = most effective way to promote learning (e.g. math, history), some learning happens without teaching (spoken language, face recognition). This book: is not/cannot be a recipe book for classroom practice, cites foundational articles not fads, not about neuroscience/biology, does use cognitive psychology (good empirical evidence, not about goals of education).</p>	<ul style="list-style-type: none"> • Some effective methods may not be intuitive – like the Fosbury flop wasn’t to high jumpers • There is evidence, but it’s an inexact science’ • Pseudoscience always spreads faster than science • Exercise caution in translating research
<p>Section 1. The Science of How We Learn. 1.1 The Scientific Study of Learning and Teaching: Cognitive Biases: Teachers (T) knowledge (K) + beliefs about education + personal experience fuel intuition re. decisions they make (large & small), brain fine-tunes memories + perceptions → cognitive biases, was practical for survival, Confirmation Bias/Cognitive Dissonance: we remember evidence that supports our views/forget or reject the rest, feel attacked when evidence doesn’t support our view, need to free ourselves from biases via scientific method (data collected methodically + analyzed logically = better bet for knowing what works). Levels of Research: neurobiological (molecular/ cellular), cognitive psychological (models learning and memory from obs. of behavior), educational psychological (multi-disciplinary field dealing with real contexts). Experiments in the Classroom: descriptive (observations to form hypotheses), experimental (changing a variable, controlling others + observing effect). Problems with Evidence: SO many (internal + external) variables → need lots of data + statistics, statistically ‘significant’ = unlikely to be due to chance. Correlation ≠ causation: can be third variable, cause/effect direction not clear (e.g. self-esteem + academic results), published replicated peer-reviewed studies = trustworthy, the devil is in the detail – big labels don’t help, use evidence backed principles of learning. Myths = distortion/ misinterpretation of findings, have many costs (time, money, learning).</p>	<ul style="list-style-type: none"> • Intuition based on personal experience may not be reliable (must go beyond it) • We have spontaneous involuntary adjustment mechanisms (biases) that influence our views • Be hyper-aware of ‘Confirmation Bias’ • Look up research when making big decisions • Beware neurobiological explanations (we’re not there yet) • Reading research – ensure control group is rigorous • Absence of evidence ≠ evidence of absence • ‘Significant’ in statistics ≠ important • Causation → correlation, but not the reverse • Data analysis prone to expectation bias • Evidence-informed not evidence-based • Pseudoscience has opportunity/financial cost.
<p>Section 2. The Cognitive Processes of Learning. 2.1 Components of Memory Multiple Memories: sensory memory (SM) = set of systems, gateway, filters + encodes incoming info, working memory (WM) (where info we are paying attention to is held + processed, critical to learning/LTM, long-term memory (LTM) (set of systems, in LTM if we remember it when no longer paying attention, includes motor skills). Explicit LTM: consciously generated through attention/WM, two types: episodic (=autobiographical) + semantic (K of world + how it works). Implicit LTM: unconsciously generated through experience, help modulate automatic responses to stimuli. Procedural memory: learning skills, cannot test without doing it, faster to learn than explicit. Conditioning: indep of explicit learning though interacts, emotional can be due to single intense response, useful for self-preservation, takes a long time to erase. 2.2 Organization of Memory Analogies and models: networks not libraries, model: new K + prior K → schemas (organization of K through meaning) = new prior K. Making Connections/ Processing/Active Learning: connections are semantic, need to activate prior K), processing deeply in terms of meaning = stronger memories, active = learning by thinking. Activating/Assessing Prior K: not enough to ask what they know about it, need qs that get them to apply prior K to learning object, assessing ≠ activating – need diagnostic qs. Learning with understanding: rote learning produces inert knowledge, needs delving using variety of contexts. Design of Activities: #1q= ‘what will they think about?’ #2q= ‘how will their thinking be visible?’. 2.3 Memory Processes Retrieval: LTM is effectively infinite, there is a trace of everything we sense but not efficient to keep all of it, 4 levels of remembering: familiarity/recognition/cued recall/free recall, 3 process essential to learning: encoding/storage/retrieval. Retrieval practice (RP) speeds up learning/gives T formative assessment but Ss need to be taught: rereading =illusion of knowing/ (desirable) difficulties are helpful/ memories reconstructed on retrieval. More cognitive effort + application = more beneficial, any tests must be low-stakes. Spaced/interleaved RP even more beneficial. Effective repetition = elaboration + spaced. Forgetting = cannot link to schema. 2.4 Reorganization of Memory conceptual change = fast if adding a new property to schemata), = slow if reorganizing schemata by changing meaning, = can be difficult due to confirmation bias, = works when new= better predictor/explainer + they have chance to try it out. 2.5 Transfer of Learning transfer challenging → needs schemata additional to problem to be activated. Transfer can be near (similar problems, easy) or far (superficial different, same underlying structure, hard). Concrete e.g.s good initially, then needs variety to produce meaningful learning = transfer to new situations. 2.6 Working Memory Limited (cannot be expanded, hard to measure reliably, increases with age/K) needs constant dynamic attention, sensitive to stress/anxiety/emotion/earworms + processing demands. Luckily dual-coding → two channels (verbal/visual). Cognitive Load (CL) Theory: intrinsic/germaine (necessary for learning)/extraneous CL, avoid overload. 2.7 Deep Learning Experts have a lot of K + had a</p>	<ul style="list-style-type: none"> • Everything we experience leaves trace in LTM • LTM can be minutes/hours/days/years • Memory model: • Episodic/semantic not the same but related • Learning gave us huge evolutionary advantage • Implicit (procedural) memory does not follow memory model • Reading is procedural knowledge, can’t not • The more you know the easier it is to learn • We connect new K when it shares properties, context, cause/effect etc. with prior K • Memory is the residue of thought • Active learning = linking to relevant prior K by seeking meaningful connections • Check they have the relevant prior K • Aim for depth not breadth for deeper K/U • Design activities based on thinking not doing • If you can’t retrieve it you haven’t learned it • Consolidation continues for minutes/hours after we stop paying attention • Few Ss engage in spontaneous RP – we need to set it up/inform them • They won’t know if we don’t teach them the how and why of RP • RP helps application/transfer too • Memory ≠ muscle, needs deliberate practice • What they already know can get in the way • Provide lots of opportunities for them to use new concepts (where old ones don’t work) • Avoid over-contextualization once basic ideas have been learn • Beware ‘curse of the expert/knowledge’ • Capitalize on dual-coding (+ don’t read slides) • Reduce/eliminate extraneous CL • Always consider CL: what do they need to hold and process? Can they offload infor?

<p>lot of practice = have cognitive flexibility/ability to see through superficial differences/reason better/solve problems faster than novices. K = more creative + better critical thinking. T must break it down then build it up + practice = automaticity when desirable or just in LTM.</p>	<ul style="list-style-type: none"> • Novices → experts by deliberate practice (lots) • Decide what needs to be automatic (e.g. reading, times tables).
<p>Section 3. Social and Emotional Factors in Learning. 3.1 The Role of Emotion in Learning 2 impacts of emotion (automatic response to threat/opportunity): intensify memory (if involves surprise/curiosity but may just enhance episodic not semantic memory) or undermine learning process (clogs up WM with unrelated thoughts). 3.2 Motivation = emotional response mediated by cognitive factors, process not a goal. Goals = learning (😊), performance (😞) + approach/avoidance strategies, may vary with age/subject. Motivation = decision based on subjective value + expectations. Value → 2 types: intrinsic (= individual interest OR situational interest), extrinsic (utility/reward/achievement). Expectations → efficacy (can I do it), outcome (will it help me reach my goals). Academic success ↔ motivation (people didn't always think this), but don't dumb down. 3.3 Beliefs self-efficacy beliefs = experience + attributions associated with them. Ss attribute success/failure to things that are: internal/external, fixed/variable, in/out of my control. Attributions can be trained, supported with feedback (about work not student), need to discourage limiting/ stereotypical beliefs about 'ability', but research into 'mindsets' mixed. 3.4 The Social Dimension of Learning T verbal/non-verbal communication establishes environment: supportive/non-supportive, adds to S subjective value/self-efficacy to determine behavior: apathetic/defiant/frustrated/evading/fragile/motivated. Pygmalion Effect: our expectations → our behavior → they fulfil those expectations. Social interaction-based learning effective when S: actively participates, assesses explanations, explore inconsistencies, explain to peers. Cooperative learning: careful structuring + assessment/grading, mixed groups better.</p>	<ul style="list-style-type: none"> • Effect of emotion on learning is not simple • Care with explosions (safety <i>and</i> learning!) • Learning ≠ performance • Work on situational interest >> fun • Be passionate, explain why it's important/ useful/ possible for them to learn too! • Early success enhances self-efficacy enhances motivation produces more success • Self-efficacy ≠ self-esteem, former better correlated with academic success • Help them attribute success to their own effort by showing it does • There are no positive labels (incl. 'smart!') • Is your learning environment supportive or non-supportive? How do you know? • Are your expectations of all students high? • Be aware of effect of stereotype threat • Need to teach them how to cooperate/ work as a group, can be beneficial.
<p>Section 4. Self-Regulation of Learning: 4.1 Metacognition happens when we reflect on our ideas/beliefs/mental processes/cognitive performance then intervene. Metacognitive (MC) skills = assessing understanding of learning goals/personal strengths+ weaknesses/planning the learning task/selecting strategies/implementing plan+monitoring progress/reflecting on suitability of choices+adjusting. Ts can model these skills. Ss with high levels of self-regulation already use MC skills, elaboration + self explanation, rest need explicit help. Learning to learn = autonomous learner. 4.2 Self-Control – research pointing to underlying skill in suppressing impulsive/automatic responses = part of executive function (higher cognitive function, starts early, necessary for academic/life success, can be nurtured, often linked to delayed gratification). Inhibitory control depletes over time/improves with age i.e. with pre-frontal cortex development. 4.3 Emotional Self-Regulation emotions can be: social or performance related (linked to value + expectations (see 3.2), arise when S anticipates challenge/faces it/see result, can lead to self-sabotage). Can be regulated by modulating: attention (redirecting/focusing on it + expressing emotions e.g. writing), bodily expressions (controlled breathing), cognitive appraisal (of value: e.g. 'this test is not that important', of expectations: e.g. 'I can handle it'), Ts can teach them how. 4.4 Resilience and Grit grit (= perseverance + passion) has a metacognitive element e.g. redirecting efforts, associated with long-term goals, linked to growth mindset. Can be cultivated (genes/twins – perseverance 37%, motivation 20%): through showing strategies produce success, teaching how to deal with failure. Some criticism of concept of 'grit' – it's just 'conscientiousness'.</p>	<ul style="list-style-type: none"> • Help them to become self-regulated learners – explicitly teach MC skills ← via modelling • Care with Dunning-Kruger effect – promote realism with focus on effort + good strategies • Remember good strategies are more effortful = less attractive + changing habits is hard • Use activities so young Ss practice self-control • Care with over-stimulating environments – will deplete inhibitory control • Teaching self-control/emotional regulation will help those who need it most • Teach Ss to control emotions in the moment by modulating attention/bodily expressions • ... + in advance by cognitive (re) appraisal – it's in their control, everyone makes mistakes • Foster environment of effort grounded in growth mindset to encourage grit • Ok to fail, focus on resilience/effort • Be demanding yet supportive.
<p>Section 5. Teaching Processes: 5.1 Instruction proven effectiveness (academic performance) e.g. using Rosenshine's principles: direct instruction, sequencing/ dosing, modelling, review, asking questions, structuring/guiding practice, 'guided discovery' can be effective for conceptual change 5.2 Feedback (FB) must provide goal + current status + what to do next. Types related to: task (FT)/process (FP)/metacognition (FM)/learner quality (FL). Effectiveness related to: timing + frequency (immediate FT, FP/FM can benefit from delay), way provided (hints good, be precise, FL has little impact), how students interpret FB (affects beliefs→motivation, need to be v.v. careful, use positive FB when learning/negative FB works when high self-efficacy+ investment in learning goal), grades (Ss can interpret grade = ability, grade can be label, given grade→they don't read FB, grade can = extrinsic motivation, good if grade reflects entire learning process). 5.3 Assessment assessments should be: valid (does it measure what it says it measures?), reliable (is it replicable and consistent?), accurate (does the grade reflect the learning we are looking for?), precise (does it distinguish one level of learning from another?). Assessments measure performance not learning, carry margin of error, better if assess transfer (writing those is hard). Formative assessment: provides data to tell decide what to do next that is better than without data, is a process not artifact. Variables: who gets data (T/S/admin...), length of assessment cycle (long - school year, medium - unit of teaching, short - on-the-fly/in lessons), quality of feedback.</p>	<ul style="list-style-type: none"> • Check instruction is evidence-informed + correct 'tool' for learning goal • 'Tool' may vary with novice→expert learners • Incorporate self-assessment / correction • Avoid 'you need to be funnier' (Dylan Wiliam) • Avoid public feedback • Think 'which mindset does this FB promote?' • 2 ways to use grades: grade everything, use assessment tests that are corrected twice • Check your assessments are valid, reliable, accurate, precise – think GPS • Avoid 'halo effect'/subjectivity in grading <p>Formative assessment:</p> <ul style="list-style-type: none"> • Means → data → decision • Helpful if decision making moves from teacher to student → independence • Assessment good for retrieval and memory • Distinguish assessment FOR learning from assessment to fulfil academic record.
<p>Appendices Neuromyths: learning styles, critical periods / enriched environments, 'we only use 10% of our brains', 'right brain/left brain' and logical/creative.</p>	<ul style="list-style-type: none"> • Don't be fooled! There is opportunity cost. • Examine evidence for any claims.