

Cognitive Load Theory (2023) by Greg Ashman



Planning Summary by Helen Reynolds <https://itslearningcurve.education/>

Content	Do This/Remember This
<p>1. Why Cognitive Load Theory: Dylan Wiliam (2017) said “Cognitive Load Theory (CLT) is the MOST important thing for teachers to know”. Sweller’s original (1982) observations with maths problems: means-ends analysis (MEA) is taxing = no resources to find patterns → can happen a lot (e.g science expts). Zeroth Law of CLT: activity/engagement may/may not → learning. Original research (replicated): worked example + problems = better transfer/more guidance better than less guidance, worked examples (WE) extremely effective.</p>	<ul style="list-style-type: none"> •
<p>2. Models of the Mind: Geary (1995) – biologically primary (BP) = language, facial recognition (effort-less, need no instruction), biologically secondary (BS) = math, science, reading, writing (effortful, needs instruction). CLT about BS, involve simple model of mind: working memory (WM) (limited, about 4 elements at a time), long-term memory (LTM) (effectively infinite, huge web of connections = schemas, schemas direct attention → what goes in WM, LTM interacts to affect WM/cognitive load. Depends on ‘element interactivity’ (EI)– what you need to hold in WM to solve problem. If large EI we can chunk or increase guidance/scaffolding, reduce extraneous load (ECL) (presented info not related to learning). Study showed pupil size correlates with CL. MEA seems BP; problem-solving skills/critical thinking are both BS and domain specific.</p>	<ul style="list-style-type: none"> •
<p>3. Simple Cognitive Load Theory Effects and How To Use Them: Lots of studies show a CLT Effect</p> <p>3.1. Goal Free Effect (Sweller & Levine 1982): Removing goal shuts down MEA, reduces CL, increases learning BUT only small set of problems work/in humanities possibilities can be huge.</p> <p>3.2. Worked Example Effect: Novices learn better from WE than by solving problems but needs structuring: same/similar → slightly different → very different = develops ability to transfer.</p> <p>3.3. Completion Problem Effect: leaving gaps for them to fill in can help transition after basics.</p> <p>3.4. Split-Attention Effect: Ss have to integrate different info from 2 or more sources = high CL.</p> <p>3.5. Redundancy Effect: Ss given 2 or more sources of same info simultaneously = high CL.</p> <p>3.6. Modality Effect: WM has two channels: verbally + pictorially – can circumvent limits of WM.</p> <p>3.7. Variability Effect: CLE NOT just about reducing CL; about optimizing use of WM. If CL low due to WE can increase safely by increased variability.</p>	<ul style="list-style-type: none"> •
<p>4. Complex Cognitive Load Theory Effects and How To Use Them: ... but effects not that simple!</p> <p>4.1. Element Interactivity Effect: Low EI = parts can be understood in isolation e.g. learning a word, high EI = can’t, e.g. solving algebra problem. Holding in WM + manipulating = higher CL.</p> <p>4.2. Expertise Reversal Effect: (extends 3.2) More expert students: hold whole schema in LTM/frees up WM, WE become redundant/can impede learning, need more varied problems.</p> <p>4.3. Guidance Fading Effect: as per 4.2 go from WE to problem solving.</p> <p>4.4. Transient Information Effect: (adds to 3.6) Info that needed but will be gone has to be held in WM = CL, mitigated by having notes/on screen</p> <p>4.5 Self-Management Effect: can help them by teaching about CL + 3.4.</p> <p>4.6 Self-Explanation Effect: (adds to 3.2) prompts to self-explain → more processing as long as WM not overloaded.</p> <p>4.7 Imagination Effect: (adds to 4.2) Pausing to imagine solution effective for those with well developed schema, otherwise WE better.</p> <p>4.8 Isolated Elements Effect: If EI + ECL v. high task must be broken down, then elements brought back together.</p> <p>4.9 Collective WM Effect: Group work prone to ‘social loafing’, can increase ‘working memory space’</p>	<ul style="list-style-type: none"> •
<p>5. A Case Study of Productive Failure: Constructivism; Ss DO need to link new learning to existing schemas, DO NOT have to construct knowledge. Kirschner & Sweller (2006) inquiry/ PBL etc don’t work, CL too high for novices who need all the info + worked e.gs. etc. Push back: debate narrowed to not ‘if’ but ‘when’ → Productive Failure (PF). Kapur (2014) Ss given problems before instruction did better than vice versa. Possible mechanisms: priming, shows limits, showing deep structure. Author’s PhD research: test predictions of PF vs CLT. Problems must be: accessible to novices, allow for multiple solution strategies, active PK, allow for direct instruction (DI) that builds on their strategies. Result: DI first scores better than PF</p>	
<p>6. Bringing Cognitive Load Theory to Your Classroom: CLT applies to BS knowledge – need to be clear WHAT you want them to learn. What to do: remove ECL from all materials, review materials in terms of their EI, use formative assessment often if not sure of CL, consider what you the teacher has to process in your WM. What to avoid: spending too long adapting lesson plans/ materials– suboptimal materials delivered well will be fine, talking about CL to people not into it, burnout (!) – sometimes a project/motivational ‘history’ day etc. is fine. CLT relevant when goal is to maximise learning: motivation and achievement positively linked. CLT is for life, not just a new fad, need to understand the original research to avoid oversimplistic mutations and apply strategies that benefit students.</p>	<ul style="list-style-type: none"> •