

The Role of Cognitive Load Theory in Selecting, Designing, and Implementing Instruction for Students and Teachers

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If you want
the slides



2023 OSEP LEADERSHIP AND PROJECT DIRECTORS' CONFERENCE





2023 OSEP Leadership and Project Directors' Conference



DISCLAIMER:

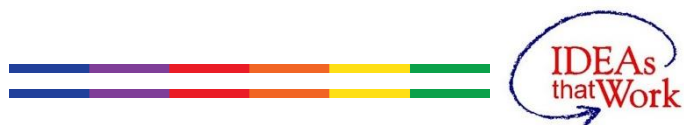
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SCHOOL *of* EDUCATION
and HUMAN DEVELOPMENT

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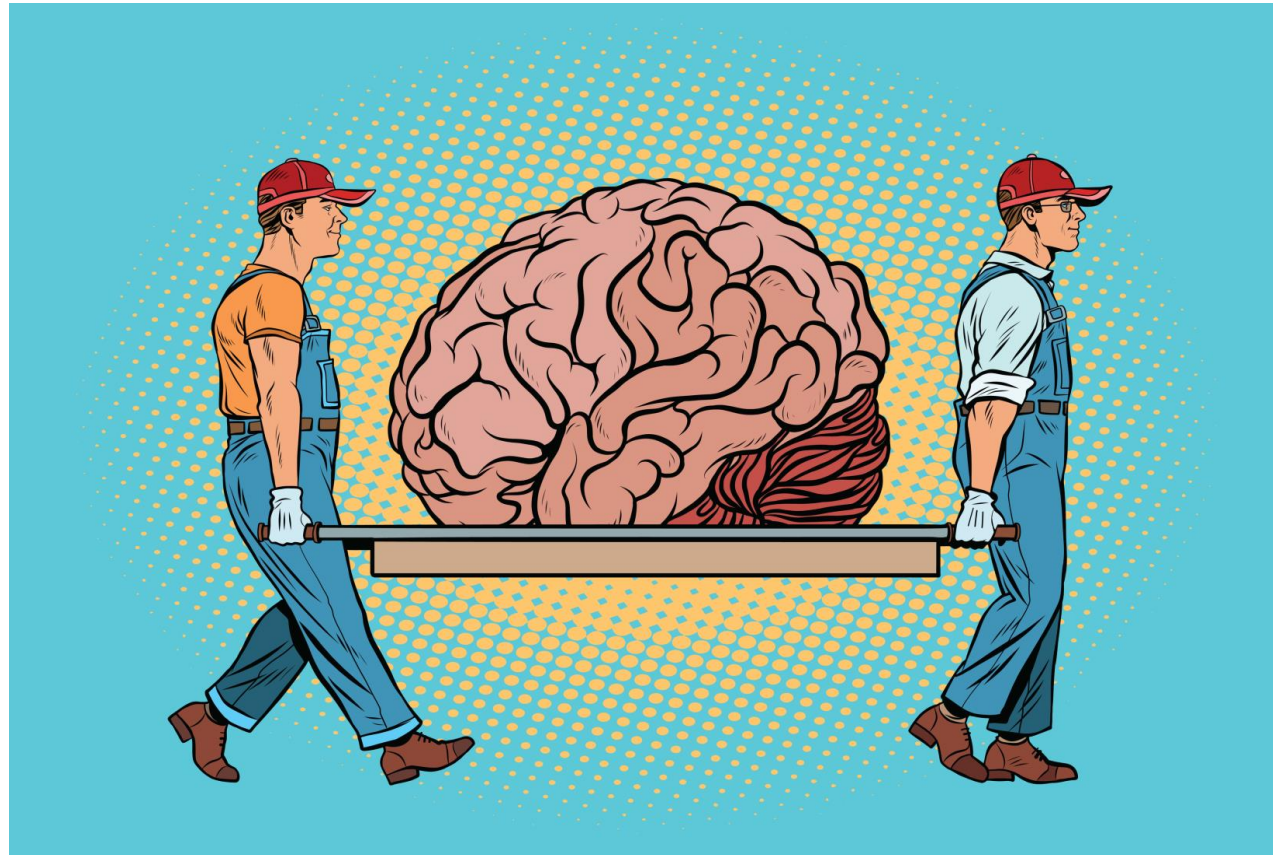


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What happens when the brain is overloaded in any given moment?



Please indulge...



We all have at least one of these in our wallet



We constantly draw from checking/bank accounts



Most of the time, we don't even think about how much money is coming out of the account



When buying most items, there is no worry at all because you have a vague idea of how much you have in the account (a lot) vs. what the item(s) cost (not much)...

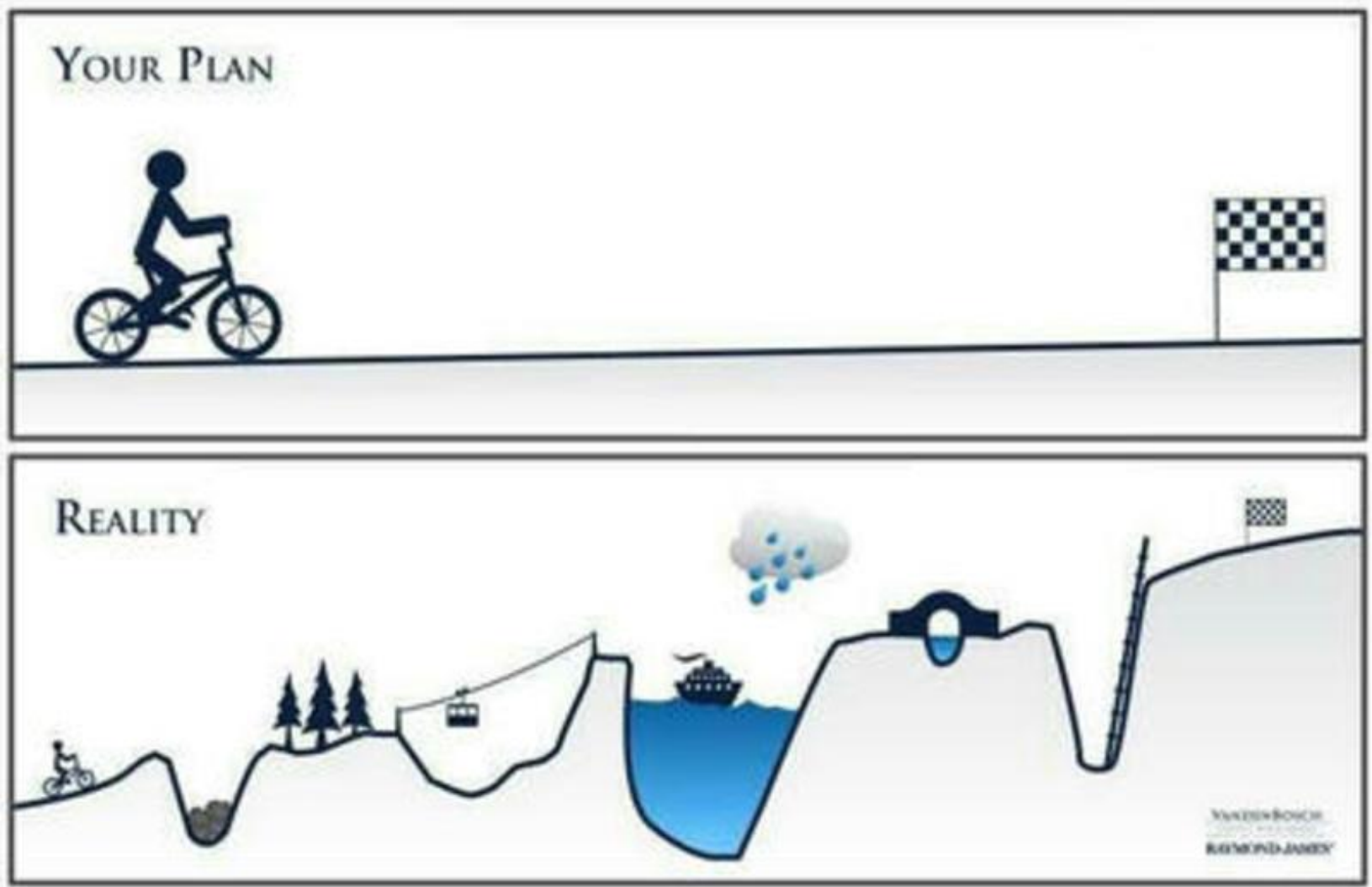


Your brain quickly processes that everything is fine, and the purchase can be successfully made



When the costs are low and funds are plentiful,
we can perform multiple (highly impressive) tasks
at once





With that in mind, how would you feel if the clerk or wait staff said the dreaded words:
“Your card was declined”

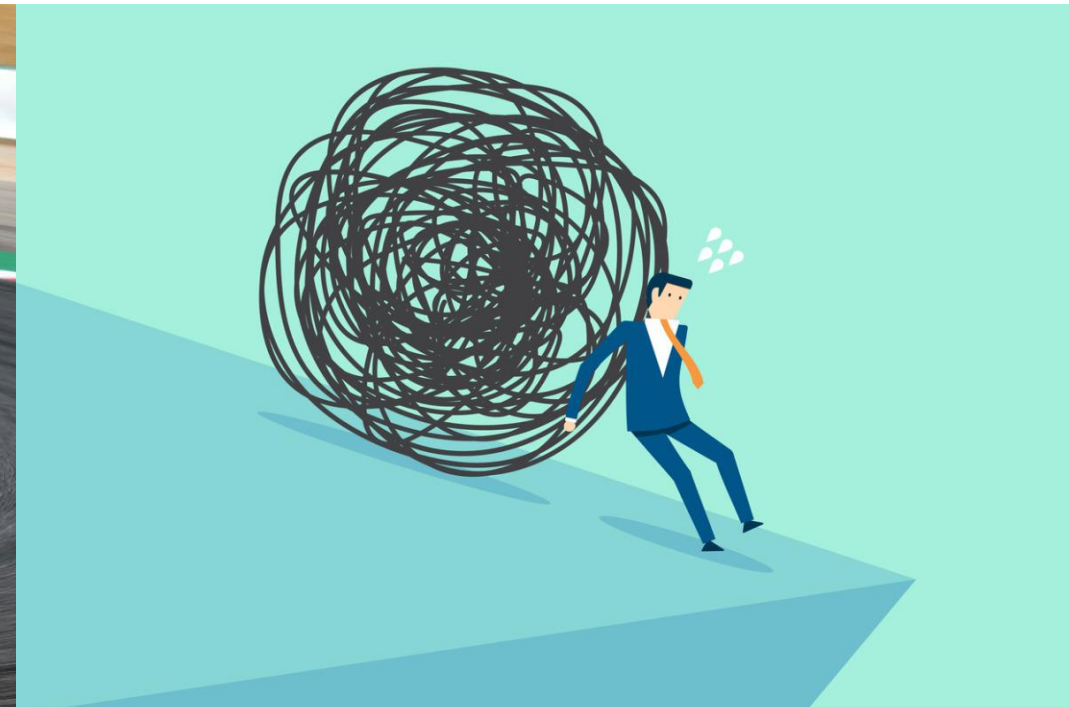




If I never have that experience again, I can die a happy man...



Whether through overspending, mismanagement, or both, an overdrawn account can happen to almost anyone. Can also be result of fraud!



The lengths I will go to avoid feeling ashamed, confused, and dread are substantial



Students in school, however, have less (or no) capacity to avoid unwanted feelings of embarrassment, failure, and dread



Adults can avoid most tasks that make us feel like the card has been declined. Students, and especially those with disabilities, English learners, and others who struggle cannot – they experience that empty and horrible feeling every single day – and we wonder why they don't like school and don't do well...



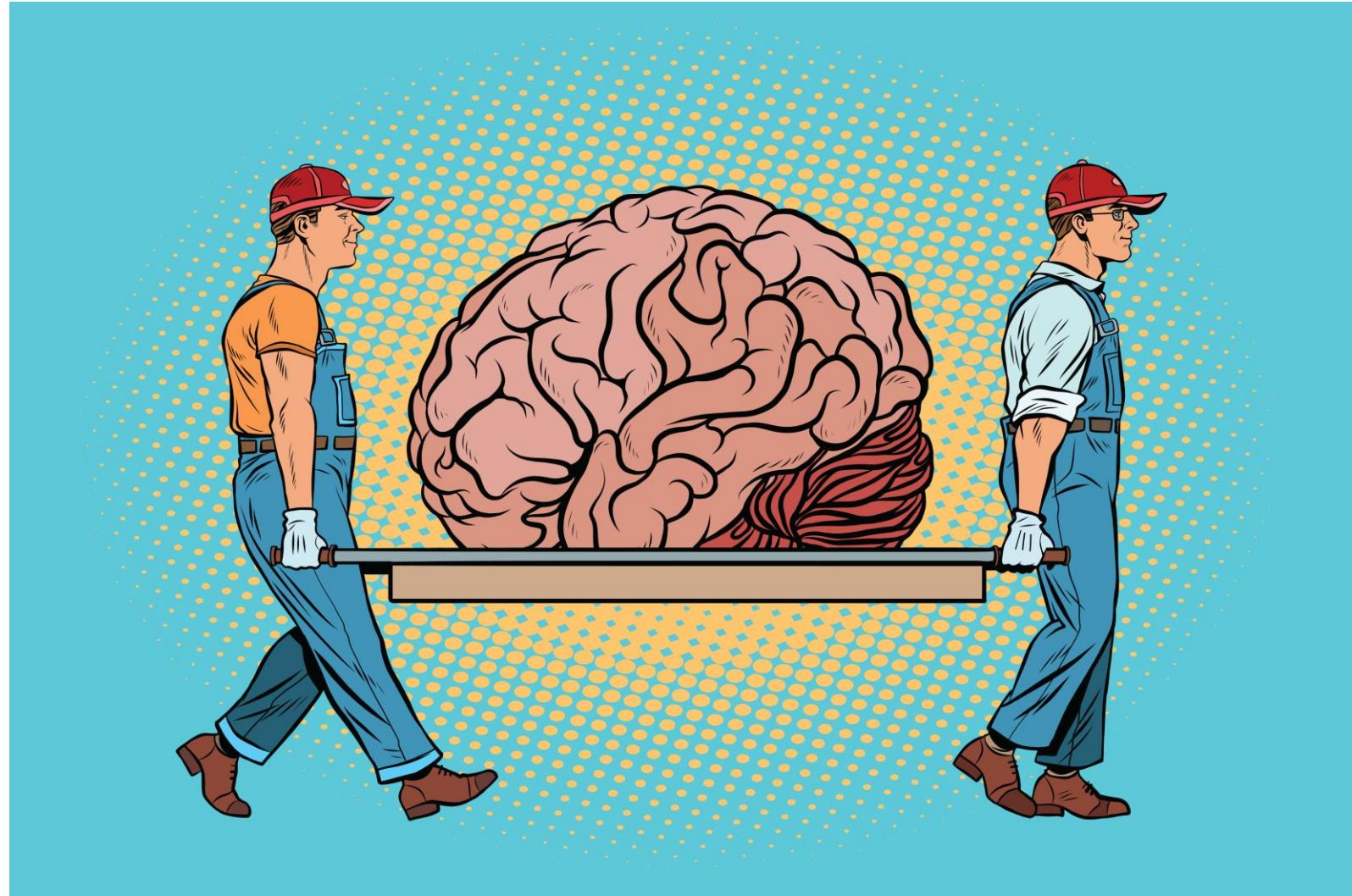
This also helps explain why some teachers quit. They don't like the feeling that comes with being constantly overwhelmed, embarrassed, and overmatched, so they use their agency and go work literally anyplace else (or nowhere – which can still be preferable to school for some).



Are We Paying Enough Attention To Cognitive Load?

(P.S. No. The answer is no)

*Implications For
Teacher Preparation &
Classroom Instruction*



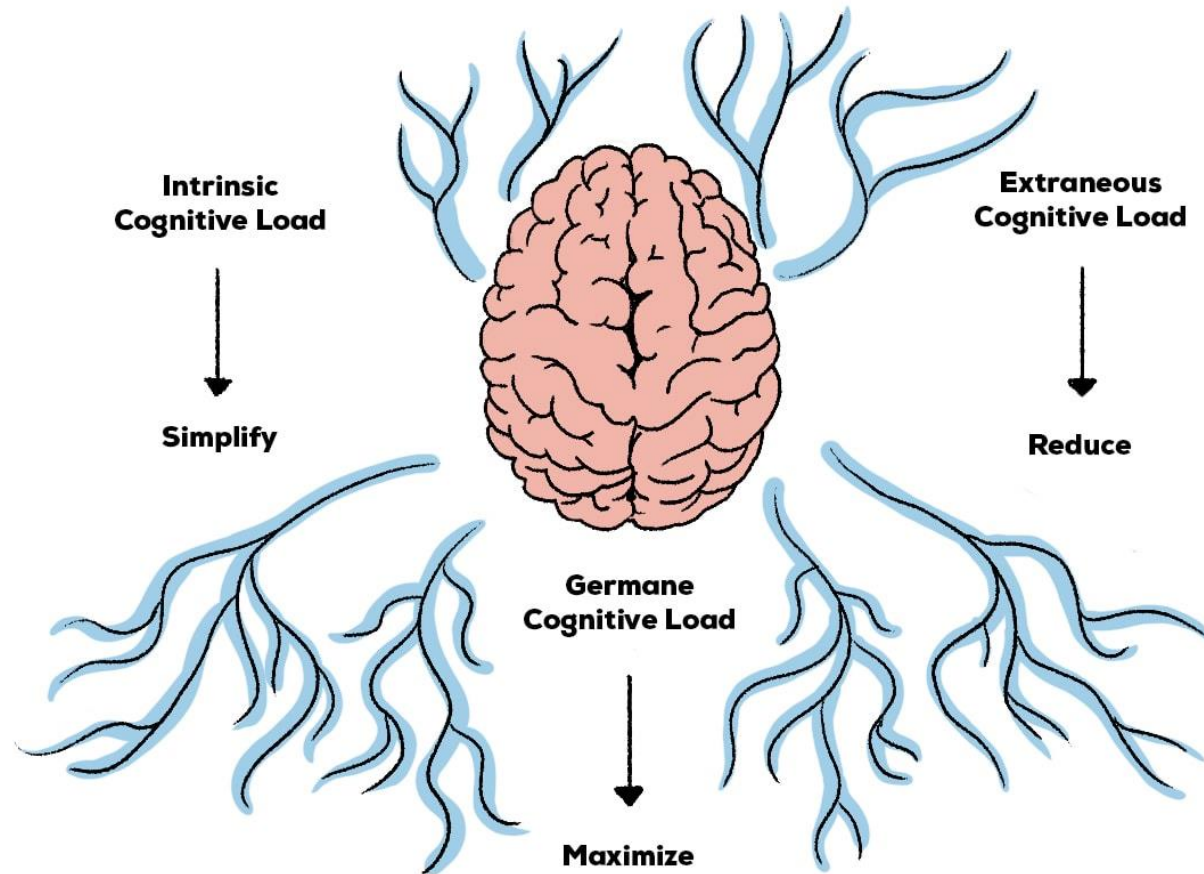
Cognitive load theory is based on the idea that all humans are limited at any given moment in terms of how much information they can process. When available working memory resources are expended, learning or performance cannot occur.



Cognitive load theory can provide us with an applied roadmap for how to design and deliver instruction for any audience



COGNITIVE LOAD THEORY



Intrinsic Load: The “cost” of using your brain to learn a new piece of information, or to complete a task (like using an evidence-based or high-leverage practice)



Different items and tasks carry varying costs – Some are cheap and easy on the account, others immediately break the bank and you literally can't buy it even if you wanted to...

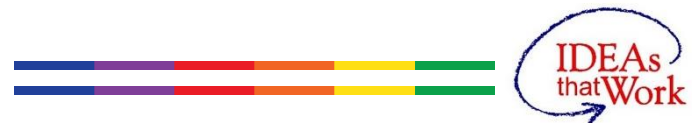


2023 BMW M8

Starting at \$136,095

8.5/10
C/D RATING

SPECS



Different items and tasks carry varying costs – Some are cheap and easy on the account, others immediately break the bank and you literally can't buy it even if you wanted to... But this will vary person to person!



Domino's logo

UNLIMITED MEDIUM
2-TOPPING
PIZZAS

\$7.99*
each

ORDER NOW

*2 pizza minimum. Prices may vary.

2023 BMW M8

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SPECS



M MM 8748



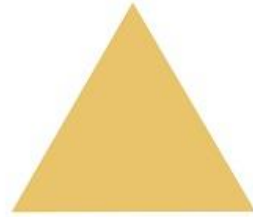
Low intrinsic load for most...



SQUARE



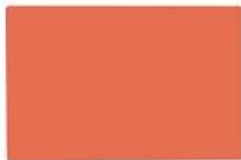
CIRCLE



TRIANGLE



OVAL



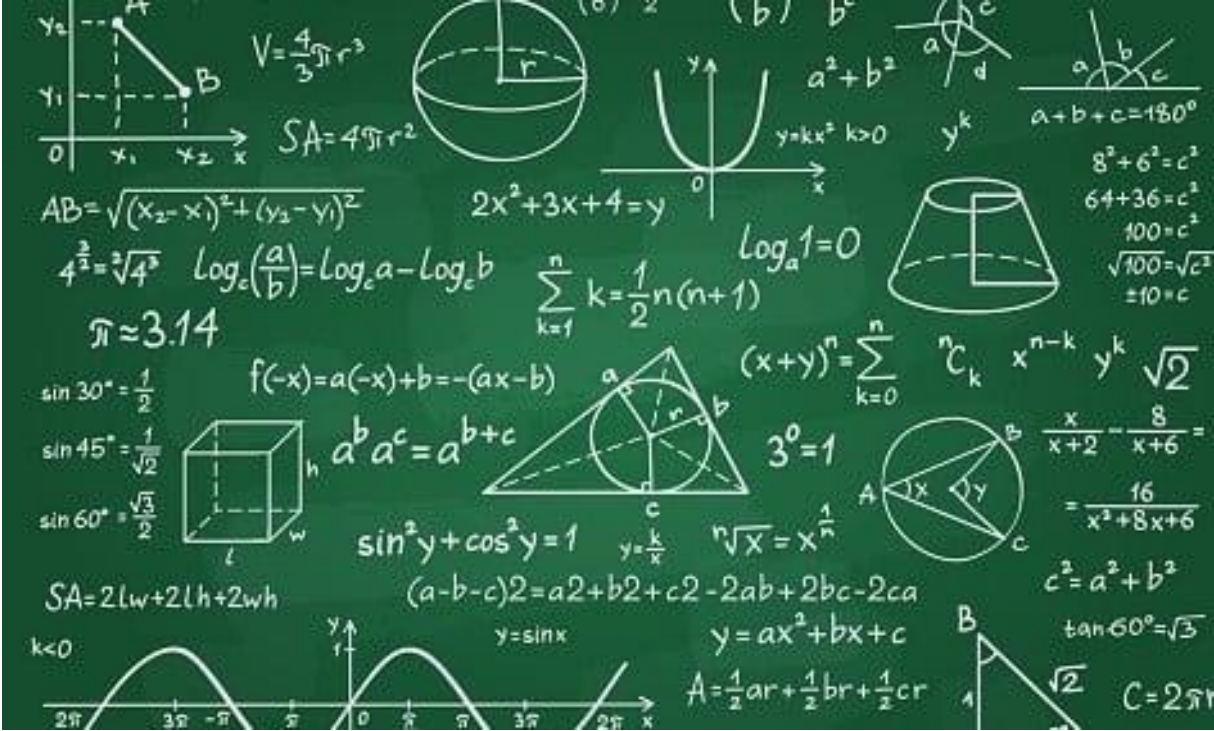
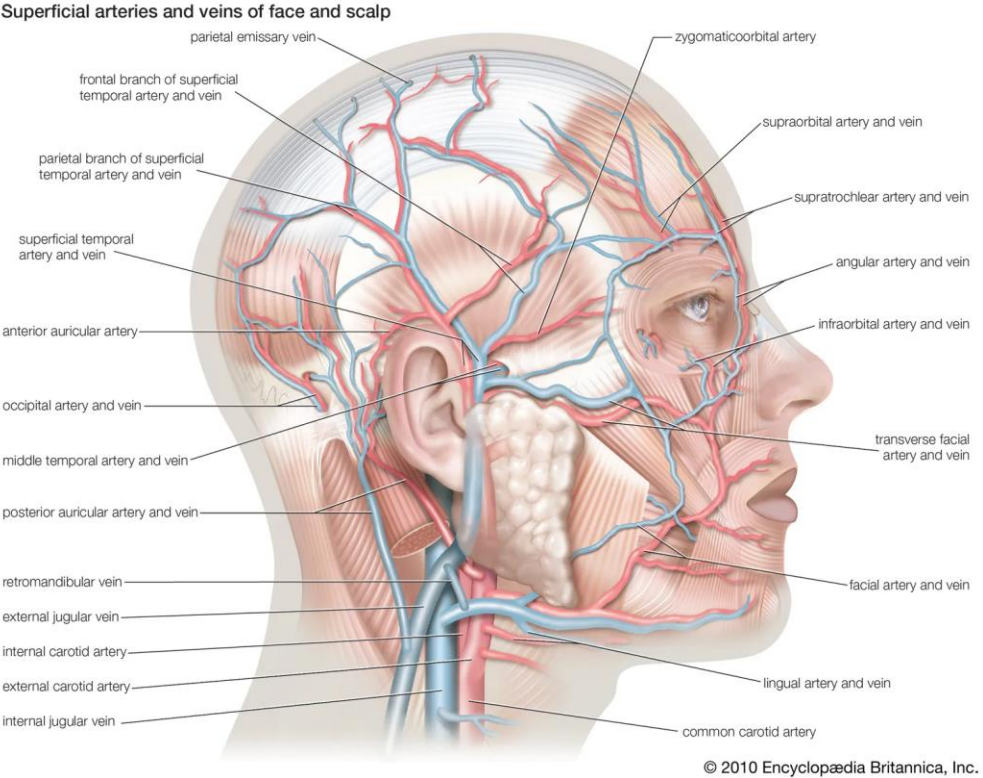
RECTANGLE



HEART



High intrinsic load for most...



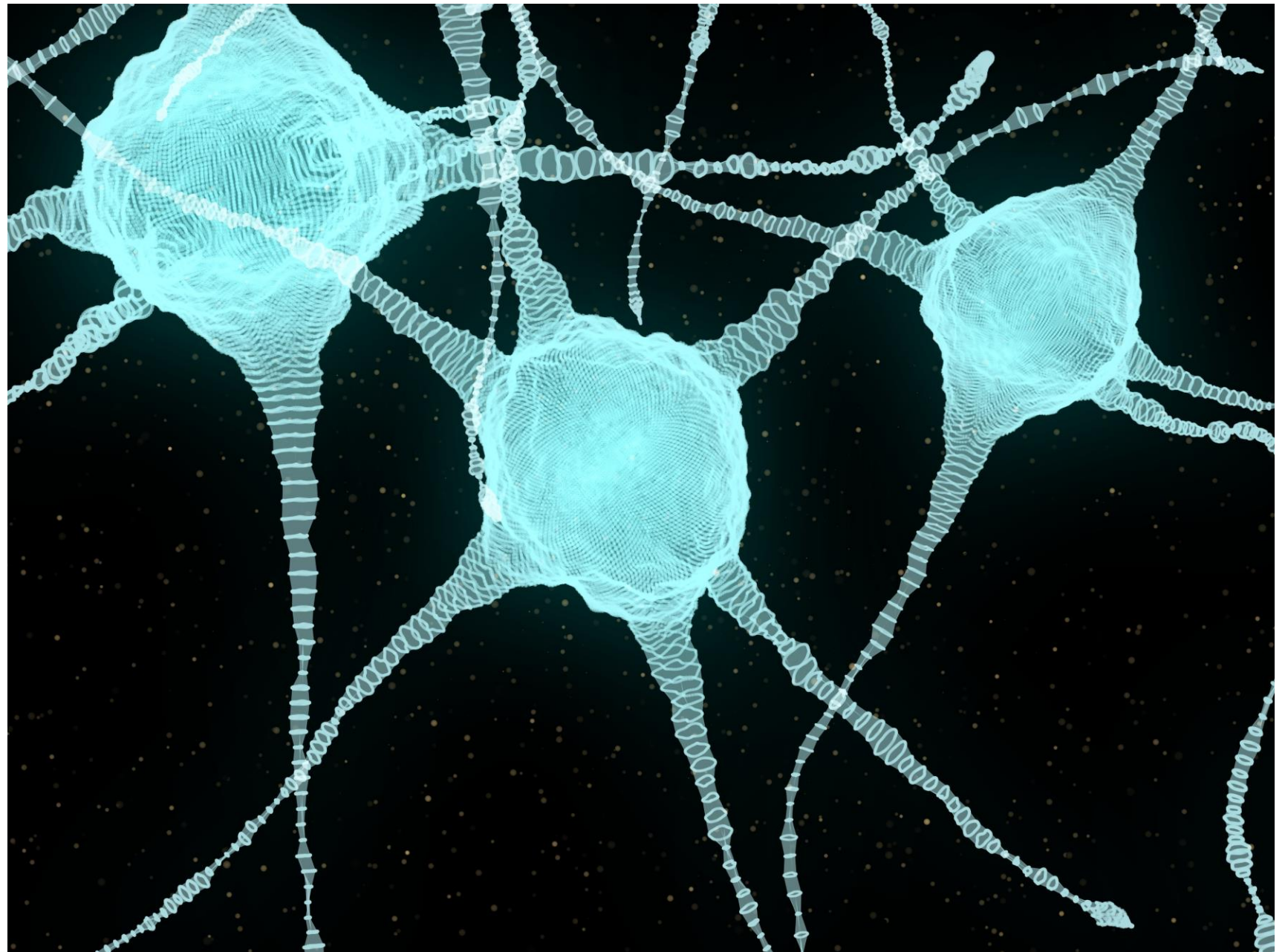
Teachers leading a well-planned lesson they have taught before, with cooperative students...



Teachers Learning and Trying New EBP/HLPs



Many students with disabilities have some level of dysfunction in terms of cognitive functionality

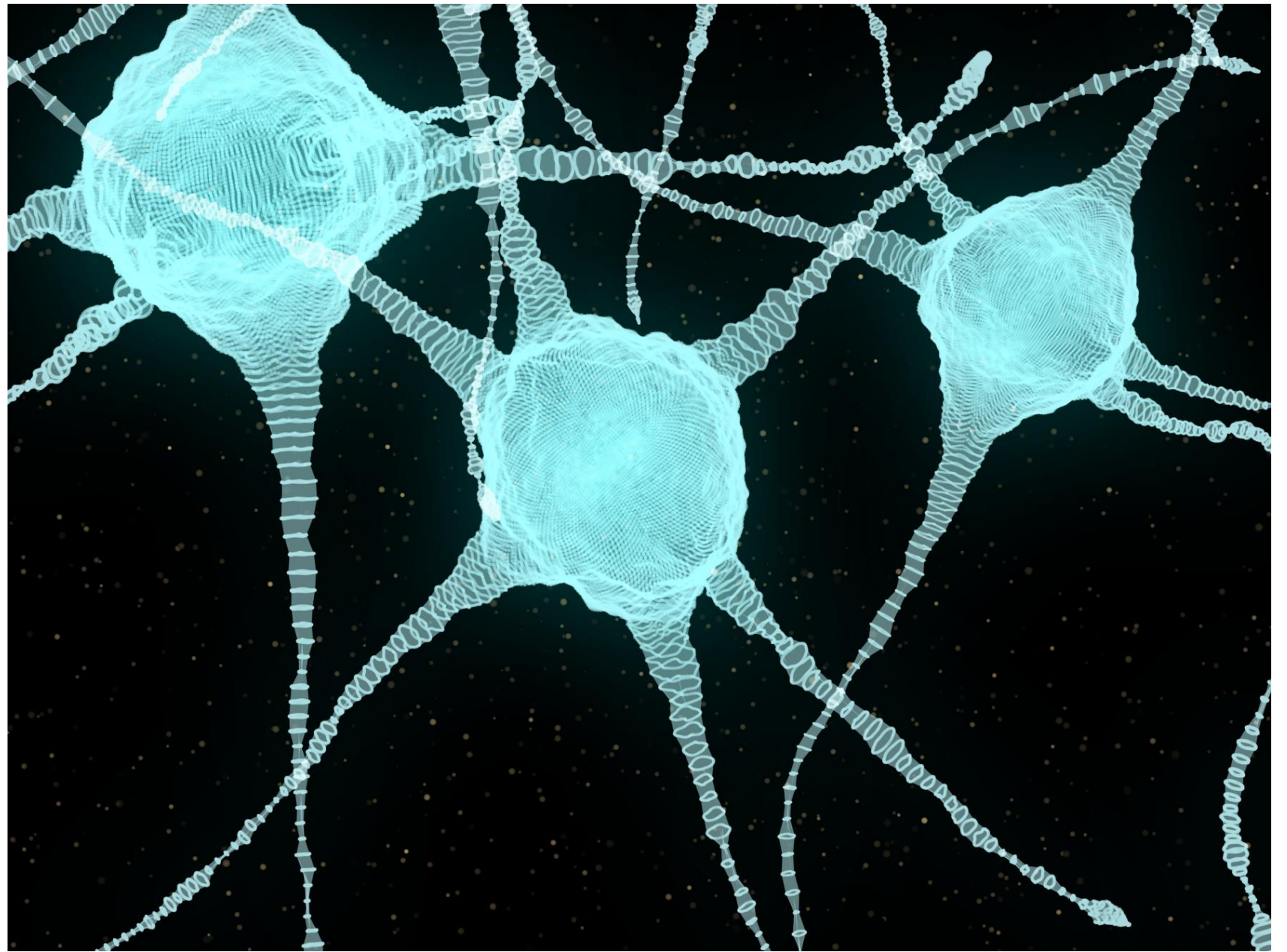


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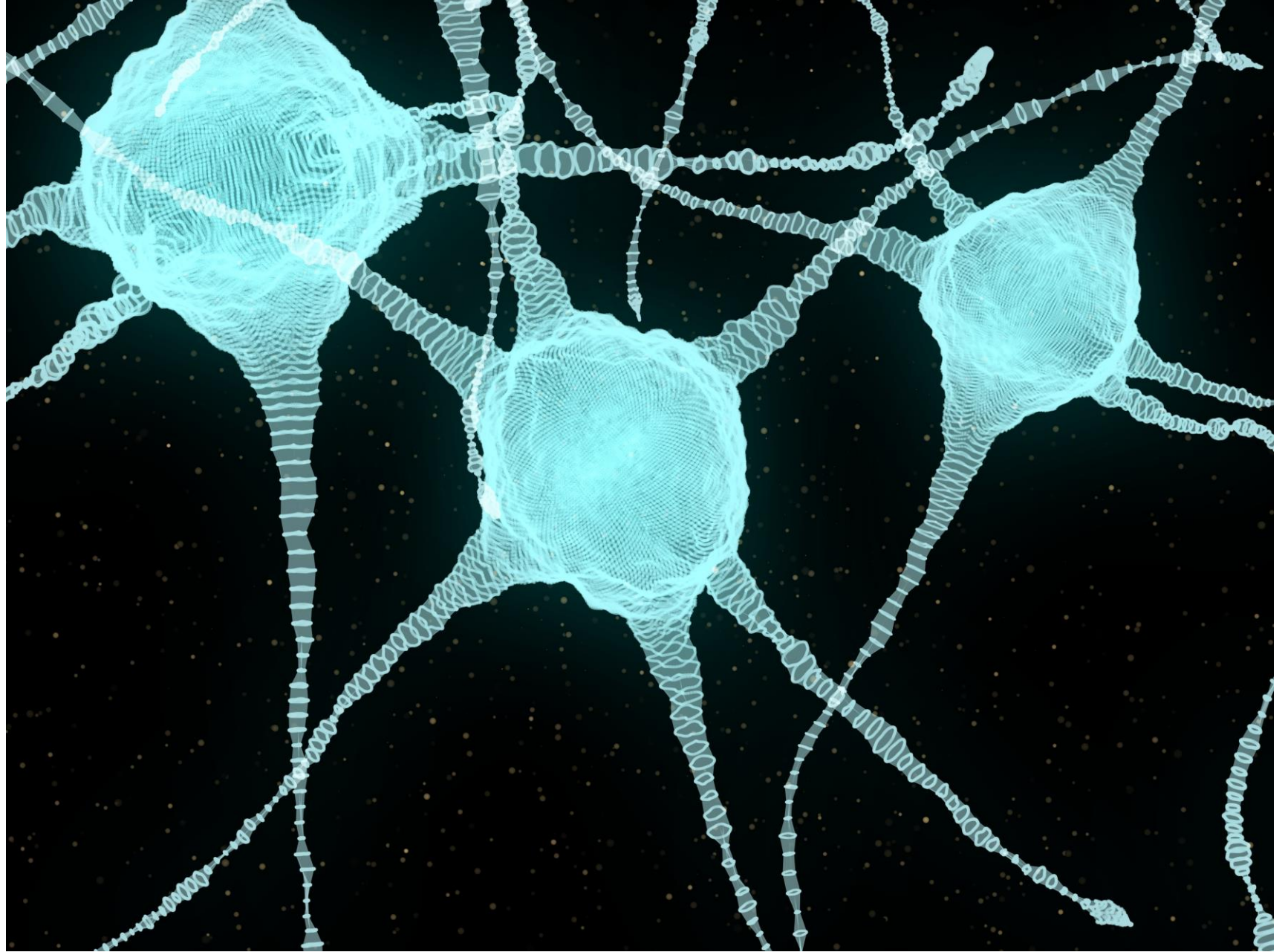


Many students
with disabilities
have some
level of
dysfunction

IL almost
always higher
for these students



Teachers
also can
struggle with
high amounts
of intrinsic
load because
they're
literally doing
things for the
first time...



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But even if the content doesn't charge much intrinsic load by itself, if a lot of content is bundled and taught at the same time/quickly, overload can occur



© China Foto Press / Barcroft Medi

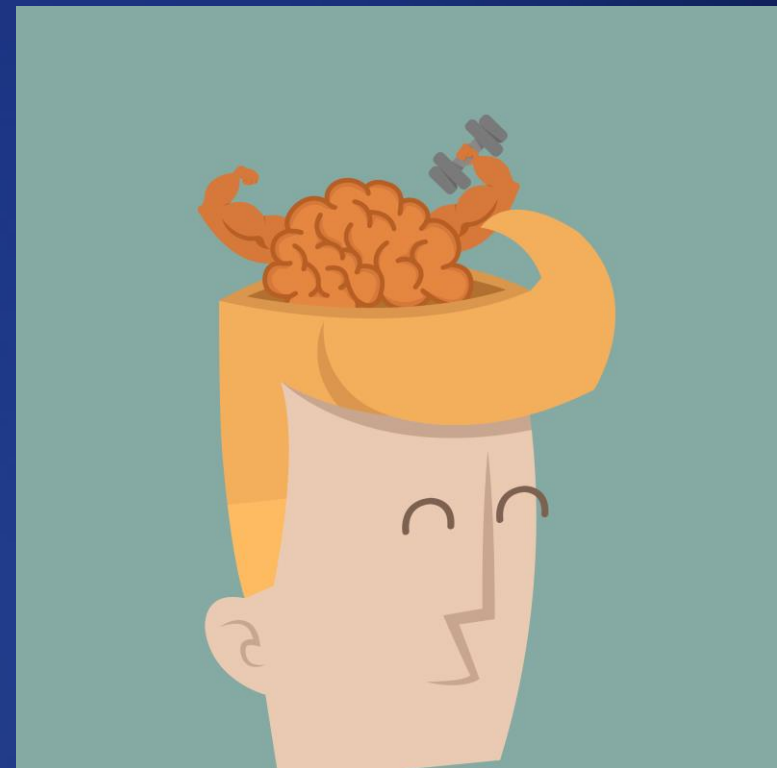


Prior Knowledge
impacts intrinsic
load

(if you have some,
IL is lower, if not...
not)



MOTIVATION DR



One of the things that makes teaching really hard: Same thing – Different costs. What gives?

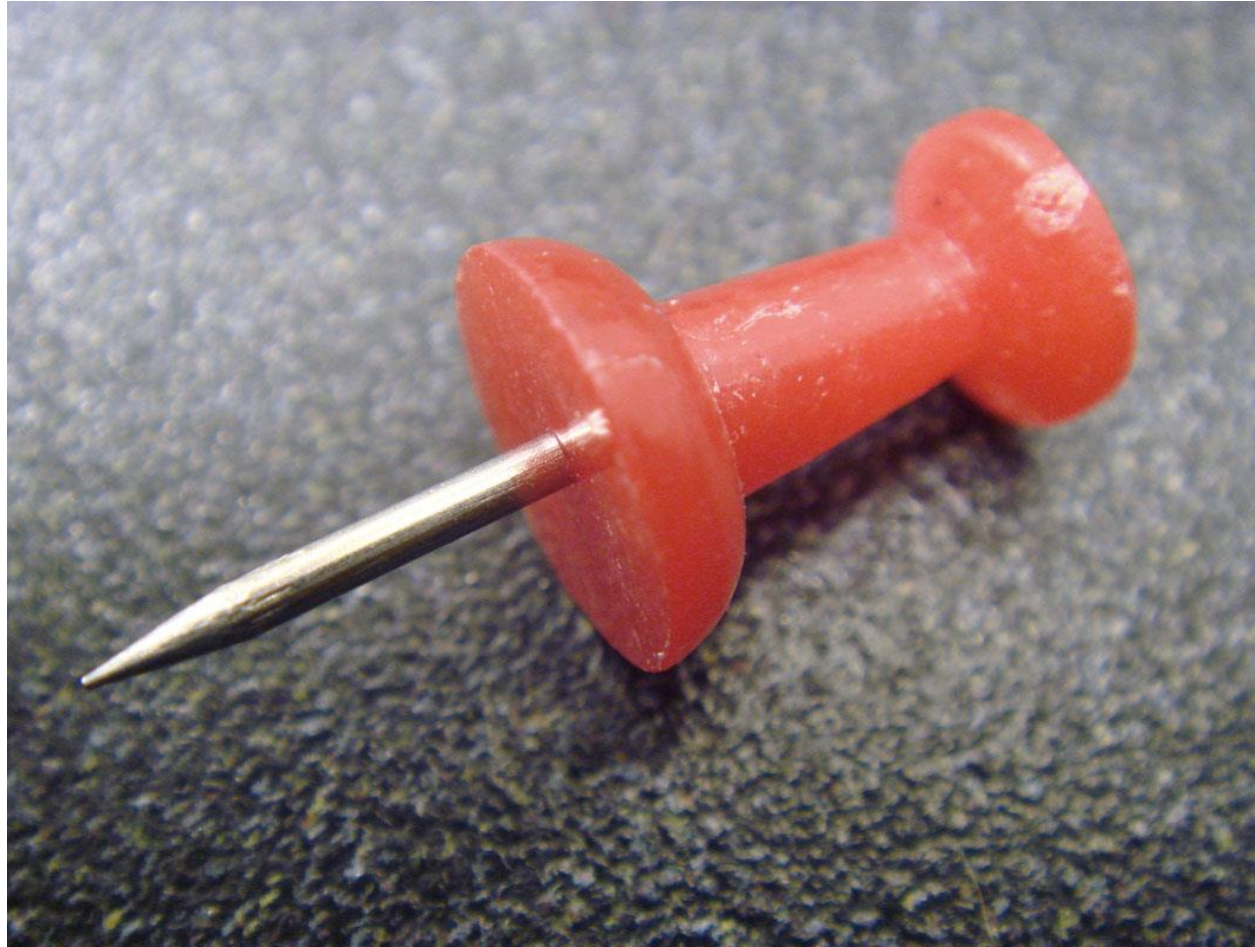
Prices of Grocery Items at Outtakes vs. Other Grocery Stores

	Jif Extra Crunchy peanut butter (16 oz.) 	Nutella (13 oz.) 	HaagenDazs vanilla ice cream (14 oz.) 	Red Baron 12' pizza 	Large Lunchable 	Small Lunchable 	Silk Almondmilk (64 oz.) 	Loaf of bread 
Outtakes in Hunt  <small>Food service for a sustainable future®</small>	\$5.59	\$5.59	\$7.00	\$10.99	\$6.00	\$3.00	\$6.99	\$4.00
	\$3.48 <small>(40 oz is \$5.48)</small>	\$3.32 <small>(an additional \$0.50 off if you use a coupon)</small>	\$3.98	\$2.98 <small>(on sale from \$3.48)</small>	\$2.38	\$1.58	\$2.98	\$1.88 <small>(H.E.B. honey wheat)</small>
	\$2.54	\$3.57	\$3.99	\$3.54 <small>(3 for \$10, or \$3.54 each)</small>	\$2.39	\$1.59	\$2.99	\$.99 <small>(Target brand, \$1.59 wheat)</small>
	\$2.48	\$3.33	\$3.98	\$3.50	\$2.38	\$1.58	\$2.98	\$1.38 <small>(Great Value, \$1.48 wheat)</small>

* All prices are before tax.



Put a pin (but don't forget as I add to your intrinsic load)



Extraneous load: Costs inflicted by how content is taught, or other distractors in learning/teaching environment



How Rivers Are Formed

- Rivers start as very small streams and gradually get bigger as more and more water is added. Heavy rains and spring meltwater add so much water to some rivers that they overflow their banks and flood the surrounding landscape.
- The water in rivers comes from many different sources. Rivers can begin in lakes or as springs that bubble up from underground. Other rivers start as rain or melting snow and ice high up in the mountains.
- Most rivers flow quickly in the steeply sloping sections near their source. Fast moving water washes away gravel, sand and mud leaving a rocky bottom.
- Rivers flowing over gently sloping ground begin to curve back and forth across the landscape. These are called meandering rivers.
- Some rivers have lots of small channels that continually split and join. These are called braided rivers. Braided rivers are usually wide but shallow. They form on fairly steep slopes and where the river bank is easily eroded.
- Many rivers have an estuary where they enter the ocean. An estuary is a section of river where fresh water and sea-water mix together. Tides cause water levels in estuaries to rise and fall.



You won't believe how important this information is

- **I've taken care to put everything I've ever heard about this topic right here on this very slide.**
 - *The information is comprehensive, well-organized, and crammed (using Calibri Font) into as many lines as will fit.*
 - Which makes me think of strategies to make more fit – like shrinking the font – that's a good move.
 - 16 point font it is. I should start using Ariel Narrow font too. That won't distract anybody
 - If you have issues reading small print, uh... move closer? Squint?
 - Not my problem – I can see it from up here so sucks to be you.
 - Plus, I'm just going to read it out loud anyway so does it even matter?
- **When everything I need to say is right here on the slide, I can just read it without deviation – wouldn't want to accidentally say anything interesting.**
 - Has anyone gotten tired of reading this garbage yet? Good – because there's still half the slide to go and I'm not even close to being done making critical points nobody cares about.
 - What is the world record for time spent without advancing the slide? I fully intend to break that record right now. You are witnesses.
- **I'm running out of time so let me just start talking even faster while using slides with a dissertation printed on them.**
 - The doors are now locked, so don't even think about trying to escape.
 - If you somehow get past the locked doors, I will release the hounds.
 - Also, the hounds have bees in their mouths, and when they bark, they shoot bees at you.
 - Submit to the reality you are here for the next hour and I've flipped the switch to block all incoming WiFi signals to prevent Facebook or Twitter from loading.



I'm getting cute with backgrounds and colors – I think it's pretty if we're being honest.

- I've taken care to put everything I've ever heard about this topic right here on this very slide.
 - *The information is comprehensive, well-organized, and crammed (using Calibri Font) into as many lines as will fit.*
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Or when what I am talking about doesn't quite match what is below... I love it - Good luck learning!!!

- It's fine to go off on tangents. Really – no consequences whatsoever. People are still smiling and nodding along – Big win for me. I said nodding – not nodding off.
- You will keep listening to me, but also keep reading all of this crap on the slide.
- Splitting your attention like that doesn't hurt your cognitive functionality one bit – trust me. People are super amazing at multitasking. Just ask the 1.6 million people involved in cell phone use related car crashes last year alone...
- Did you know the Eagles were robbed in the Super Bowl?
 - Total BS call – Handed them the game.
- Pizza is delicious. When I am king, I am going to ban all other foods from existence.
- What does that have to do with anything? Well, nothing – except your available cognitive resources are being twisted and consumed by absolute nonsense.
- I hereby vow to prevent everyone here from learning based solely on my presentation choices.
- Are you getting angry or frustrated yet? You should be.
 - Now imagine how your teacher candidates feel.
 - And worse – Imagine how the students with disabilities and English Learners feel when those teachers are going to go and teach using this “method” they saw literally every professor and PD provider they've ever had...
- Did you just have an “oh shit” moment? Good.

Paradox:

High
extraneous
load for
students...

But can be
low for
teachers

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- Did you know the Eagles are going to win the Super Bowl on Sunday?
 - At least they better.
- Pizza is delicious. When I am king, I am going to ban all other foods from existence.
- What does that have to do with anything? Well, nothing – except your available cognitive resources are being twisted and consumed by absolute nonsense.
- I hereby vow to prevent everyone here from learning based solely on my presentation choices.
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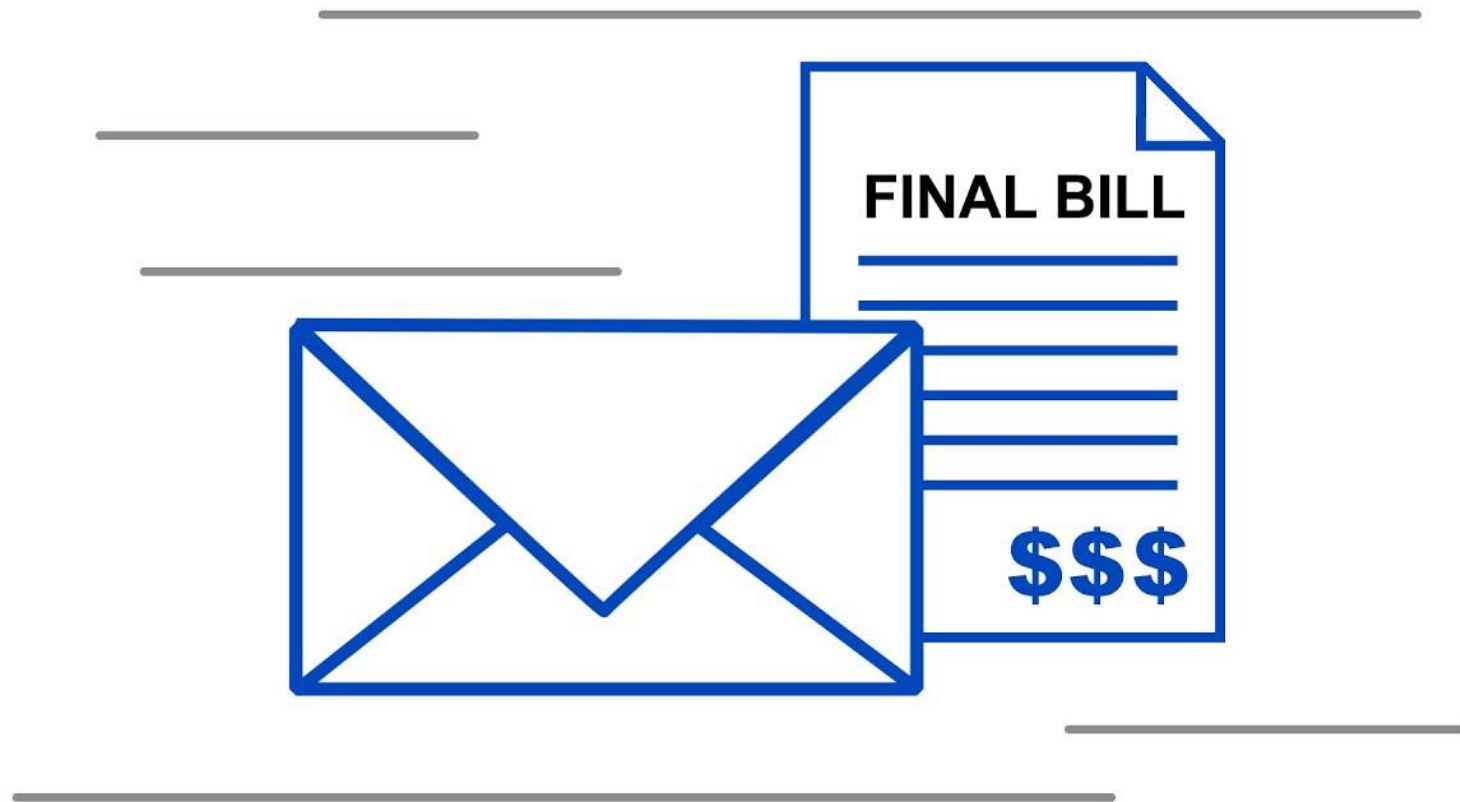
For teachers, distractions are everywhere that raise extraneous load



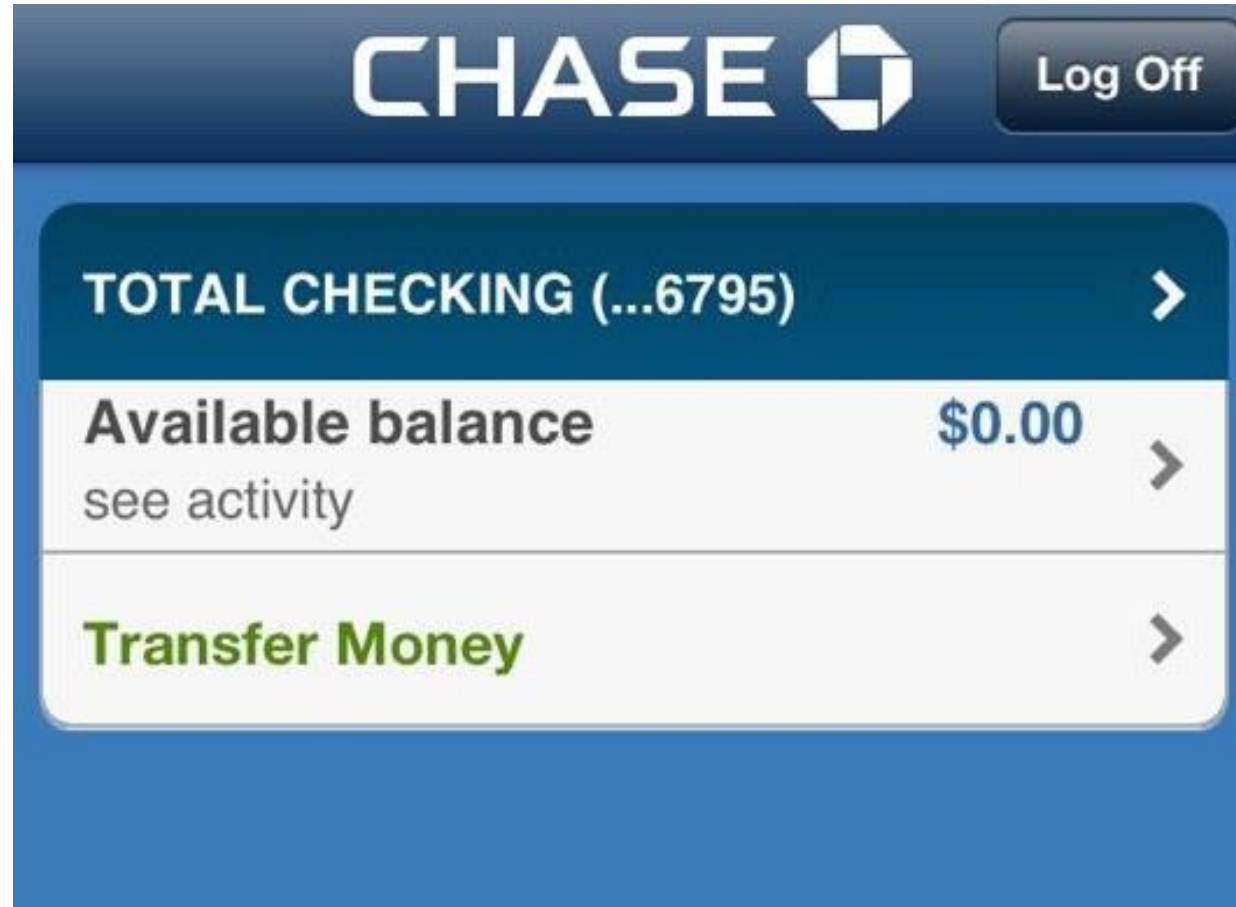
Recipe for high IL and EL: Using EBPs with fidelity, collecting data, monitoring behavior, implementing IEPs, collaborating, teaching new content, being observed, etc...



Intrinsic and Extraneous load amounts are added together and are the “final bill” that must be paid in order to successfully learn or complete a task...



If your total bill comes in higher than available funds, the purchase is declined...



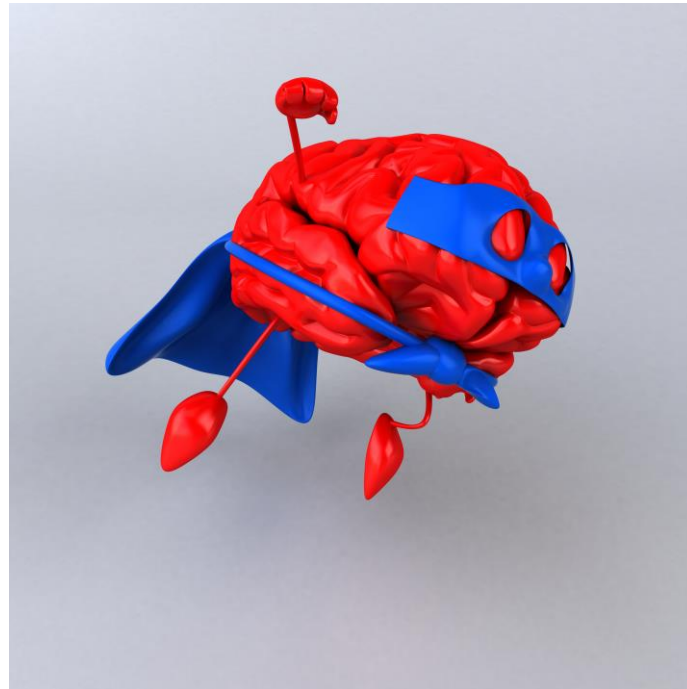
Cognitive overload for students looks like this...



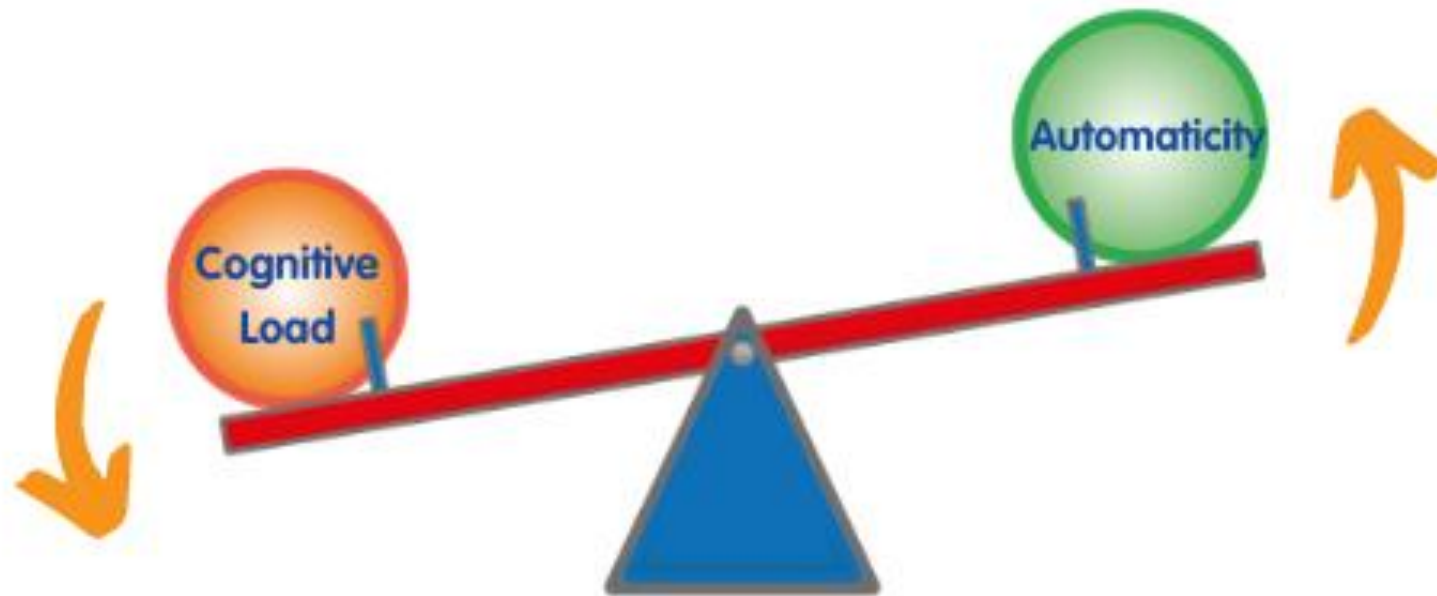
If cognitive overload for teachers had a picture, it would look like this



Germane Load: Remaining working memory capacity after intrinsic and extraneous load costs are paid needed to complete learning or teaching tasks



A goal is to build automaticity for learners and teachers with content and practices so they don't "cost" as much intrinsic load, and to make critical decisions that limit extraneous output...

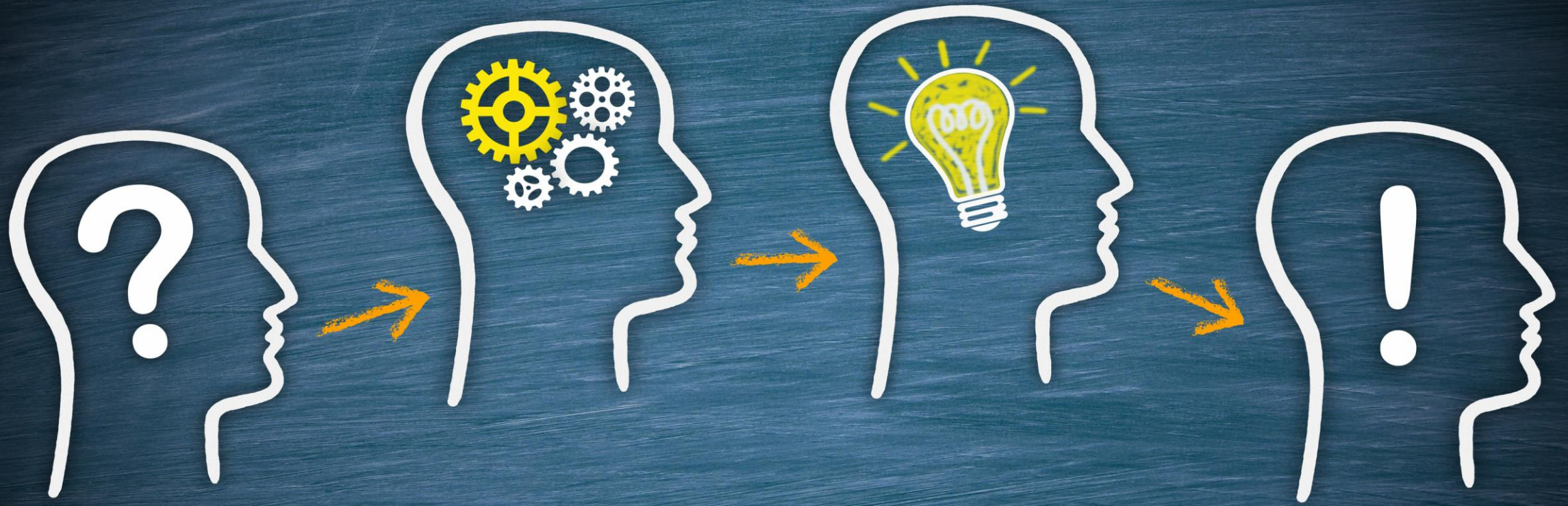


EDUCATIONAL PSYCHOLOGIST, 42(3), 123–137
Copyright © 2007, Lawrence Erlbaum Associates, Inc.

Cognitive Load and Classroom Teaching: The Double-Edged Sword of Automaticity

David F. Feldon

*Department of Educational Studies
University of South Carolina*



Implications for Professors, School Leaders, & Teachers???

For Many Students
There is a **Mismatch**
Between Student's
Learning Needs &
The Demands of the
Curriculum –
Especially in Content
Area Courses

Harbort et al., 2007; King-Sears et al., 2014;
Moin et al., 2009; Mutch-Jones et al., 2012



Demands of Content
Courses

Student's Learning
Needs

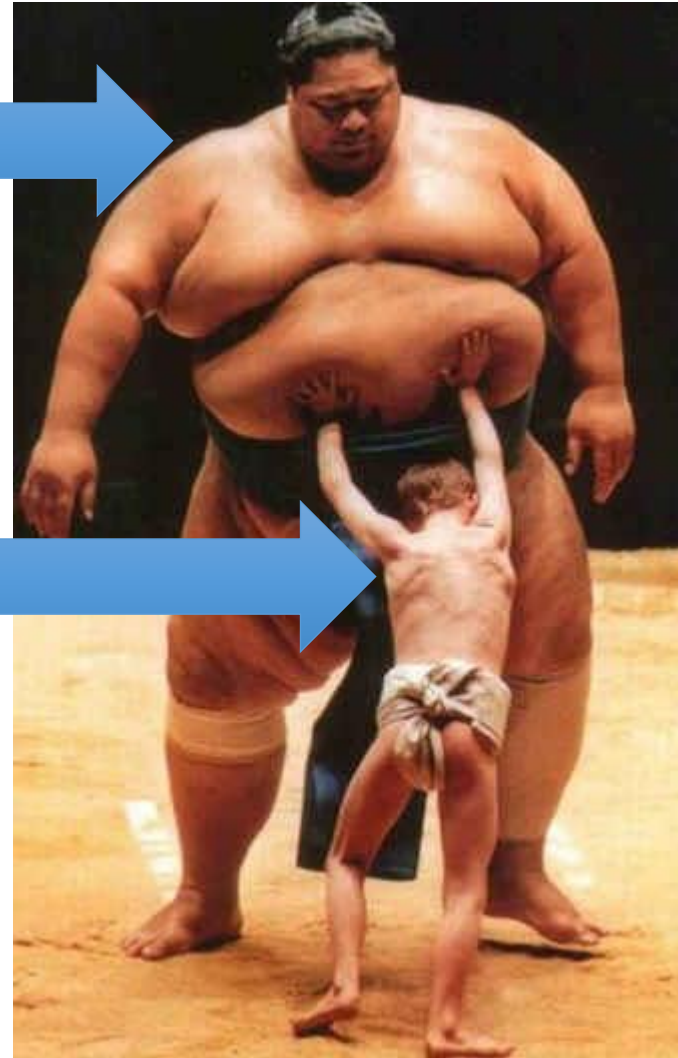


Vannest et al., 2009; Wei et al., 2010; Robinson, 2002



Prevailing Pedagogy

Student's Learning Needs



Vannest et al., 2009; Wei et al., 2010; Robinson, 2002



Also a mismatch between everything we need teachers to learn in a very short amount of time and their cognitive capacity to make sense of it all and become proficient at implementation...

Feldon, 2007



Whoops...

It's very easy to overload learner's limited cognitive capacity – This goes for teachers in training, PD, or students with and without disabilities.





Give thought to how we structure our approach for teaching from a design perspective...





Do the same for designing and delivering instruction for students with disabilities

If we know intrinsic load is going to be high, that's a signal to bring our A Game and manage extraneous load.





**BE
PREPARED**
(for intrinsic
cognitive load)





**BE
PREPARED**
(& to manage
extraneous load)



Atom

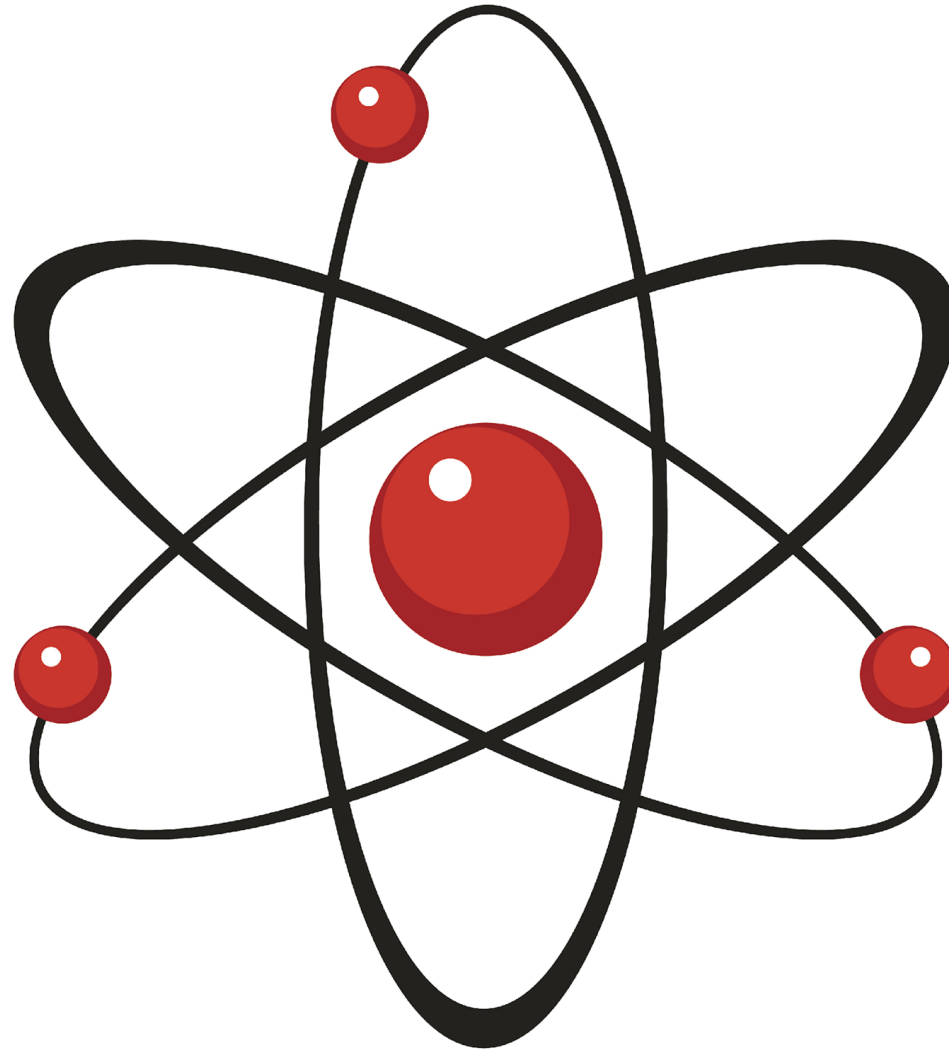
- An **atom** is the smallest unit of ordinary matter that forms a chemical element. Every solid, liquid, gas, and plasma is composed of neutral or ionized atoms. Atoms are extremely small, typically around 100 picometers across. They are so small that accurately predicting their behavior using classical physics—as if they were tennis balls, for example—is not possible due to quantum effects.

High intrinsic and extraneous load = lowest chance of learning





Atom: smallest whole unit of matter



Key Elements of Explicit Instruction

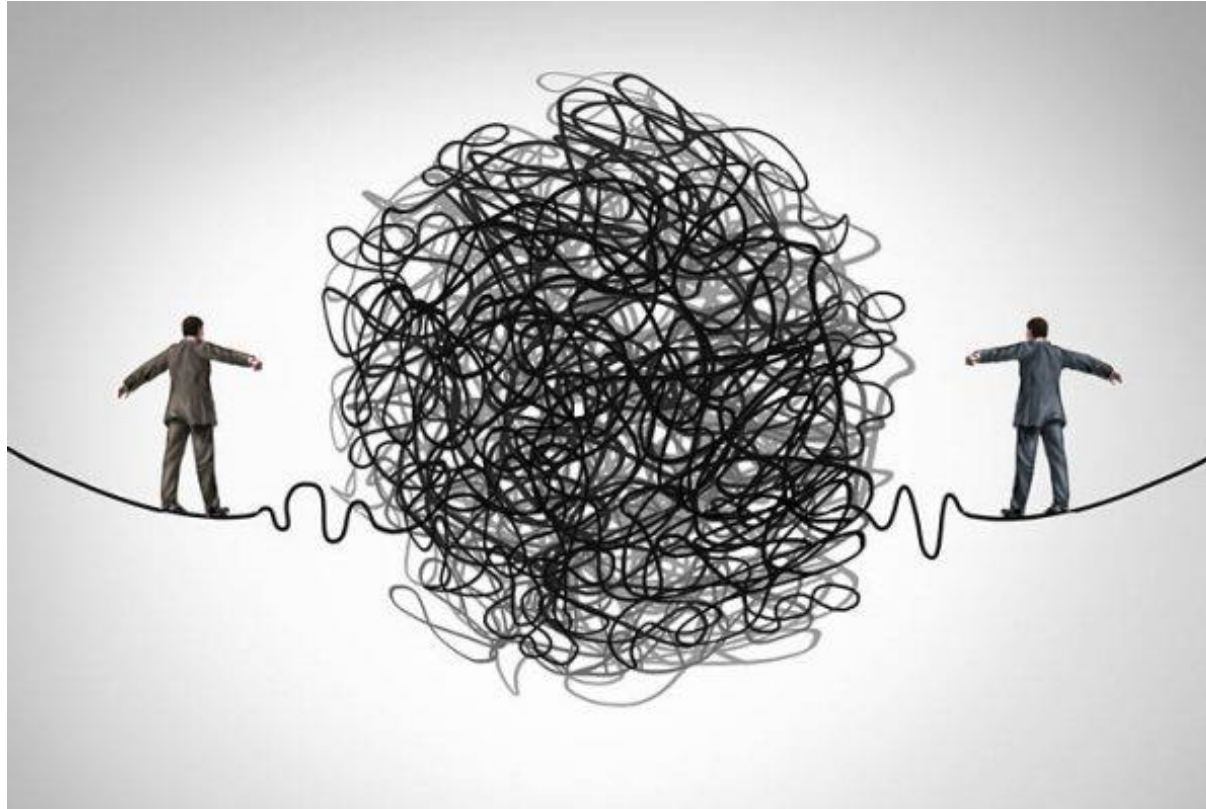
- Use clear language
- Use cues
- Break complicated content into chunks
- Make connections to prior learning
- Highlight relevant and varied examples
- Use an engaging, deliberate, and predictable pace
- Provide lots of (varied) opportunities to respond (OTRs)
- Deliver high-quality feedback
- Model (I do) regularly
- Provide guided practice (we do) regularly
- Utilize independent practice (you do) when students are ready



For our teachers in training/during PD sessions: We often give little thought to intrinsic and extraneous load because we assume a level of competence amongst students, but they are not immune to the impact of cognitive overload.



Learning individual practices is one thing – can create modest amounts of intrinsic load, but in real teaching, multiple practices are often used concurrently, generating unwieldy amounts of load – especially when teachers are new...



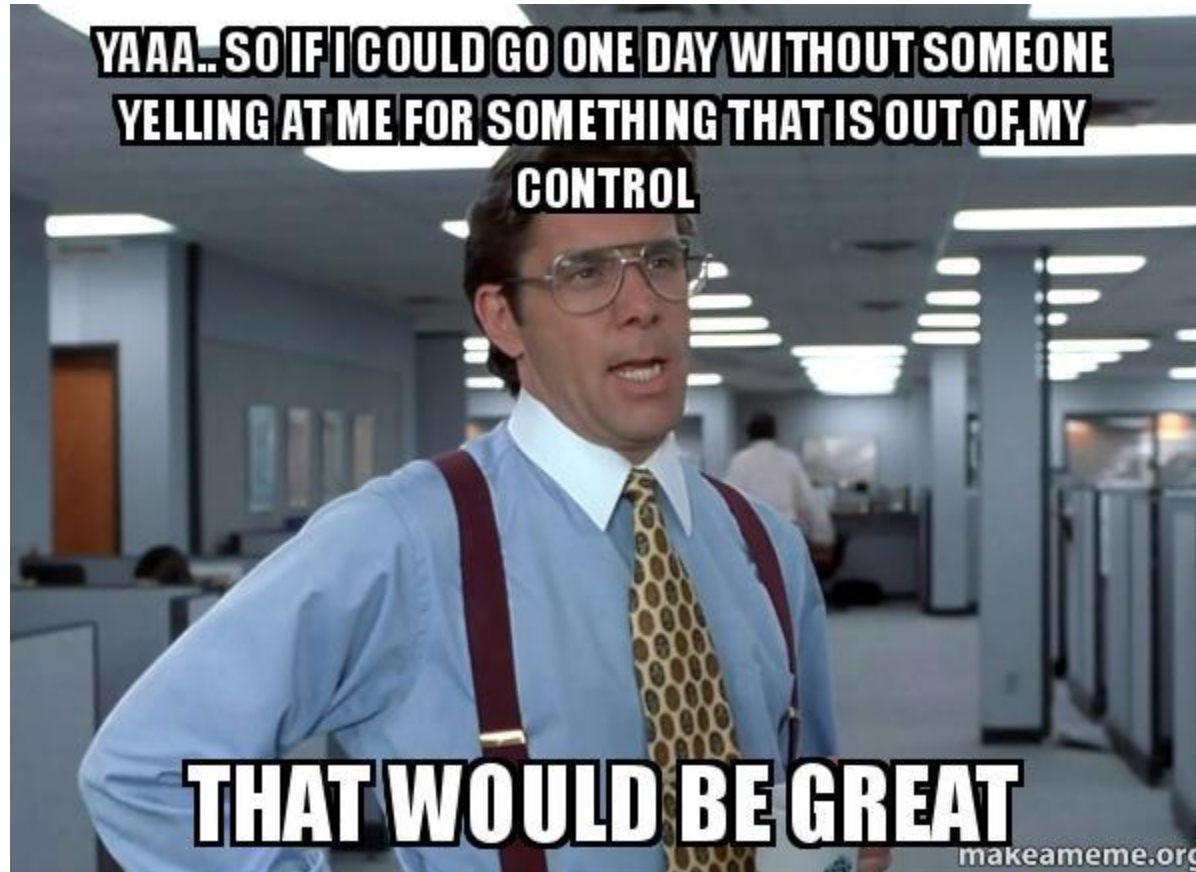
When we are rushing, cramming too much content into one lesson, lecture or PD session we are introducing additional extraneous load - And when intrinsic load is already high, results (or the lack thereof) are predictable...



No matter how big or small your courses or PD sessions are, if the main mode of learning about HLPs and EBPs is lecture/hearing about them, development of conditional knowledge is not likely.



Things out of our control as individual faculty or PD providers also negatively impact teacher capacity to successfully learn – like when and where your class/session is offered, being in placements all day before coming to campus, etc...



For complex practices, or those like HLPs that overlap (and generate a lot of intrinsic load at first exposure, and then again when being implemented by novices), it is important to mix and match how your candidates/teachers learn about and practice to distribute extraneous load and help build automaticity.



Mix and Match



Diversifying how we present information – especially at first exposure – makes a big difference in lowering intrinsic and extraneous load, and sets up for later success



Use resources like CAPs and other podcasts to reinforce lecture and reading

www.spedintro.com

The screenshot shows the Vimeo channel page for "Introduction to Special Education". At the top, there are navigation links: "vimeo", "Manage Videos", "Resources", "Features", "Watch", and "Upgrade". A search bar on the right contains the text "Search videos, people, and more".

The main content area features two video thumbnails. The first video is titled "Middle School Mathematics Co-Taught Lesson: Mrs. Benson and Mrs. Voss Northside Middle School, Roanoke, VA" and is by Michael Kennedy. The second video is titled "Sample Lesson: Reviewing Expectations" and is also by Michael Kennedy.

On the right side of the page, there are several sections:

- Buttons for "Unfollow", "Settings", and "Share".
- The channel title "Introduction to Special Education".
- Information: "Created by Michael Kennedy | PRO | 9 years ago".
- A description: "This channel contains Content Acquisition Podcasts (CAPs) for Introductory Courses in Special Education. The content of each CAPs is based on the best available peer-reviewed research, and each is produced using validated instructional design principles..."
- A "+ More" link.
- A "BROWSE THIS CHANNEL" section with the following statistics:
 - 118 Videos
 - 118 Followers
 - 1 Moderator
- A "SHOUT BOX" section with a message from Claudia Marin: "Thank you by Claudia Marin 2 years ago". Below the message is a note: "Heads up: the shoutbox will be retiring soon. It's tired of working, and can't wait to relax. You can still send a message to the channel owner, though!". There is a text input field with the placeholder "Write something brilliant here" and a "Post" button.
- A footer link: "Introduction to Special Education".



Modeling Videos of HLPs/EBPs being implemented

www.highleveragepractices.org



Back to CEC Home CEDAR Website Contact Us

High-Leverage Practices for Students with Disabilities

EXPLORE HLPs FIND RESOURCES ACCESS VIDEOS

VIDEO LIST

- Introduction Video
- Clarifying the Relationship Between HLPs and EBPs
- HLP #7: Establish a Consistent, Organized and Respectful Learning Environment
- HLPs #8 and #22: Provide Positive and Constructive Feedback to Guide Students' Learning and Behavior
- HLP #11: Goal Setting
- HLP #12: Systematically Design Instruction Toward a Specific Learning Goal
- HLP #13: Make Adaptations

VIDEO LIST

- HLP #14: Use Cognitive and Metacognitive Strategies
- HLP #15: Use Scaffolded Supports
- HLP #16: Use Explicit Instruction
- HLP #17: Use Flexible Grouping
- HLP #18: Use Strategies to Promote Active Student Engagement
- HLP #19: Use Assistive and Instructional Technologies
- HLP #20: Provide Intensive Instruction

VIEW UNEDITED CLIPS

Latest Video

Check out the most recent HLP video released: HLP #14 Teach cognitive and metacognitive strategies to support learning and independence.

ACCESS VIDEO

Watch HLPs in Action

ACCESS VIDEOS



Teach Live/ Mursion mixed reality simulator



Observe teachers in field and reflect/ discuss





Case studies, podcasts, reflection, simulated and real practice, watching modeling videos, discussion, receiving feedback, field visits, etc... Used in combinations, and repeatedly



What can we get teachers to learn and do well to achieve biggest impact?



Select which practices are most critical, and focus on those...
(for starters, anyway)





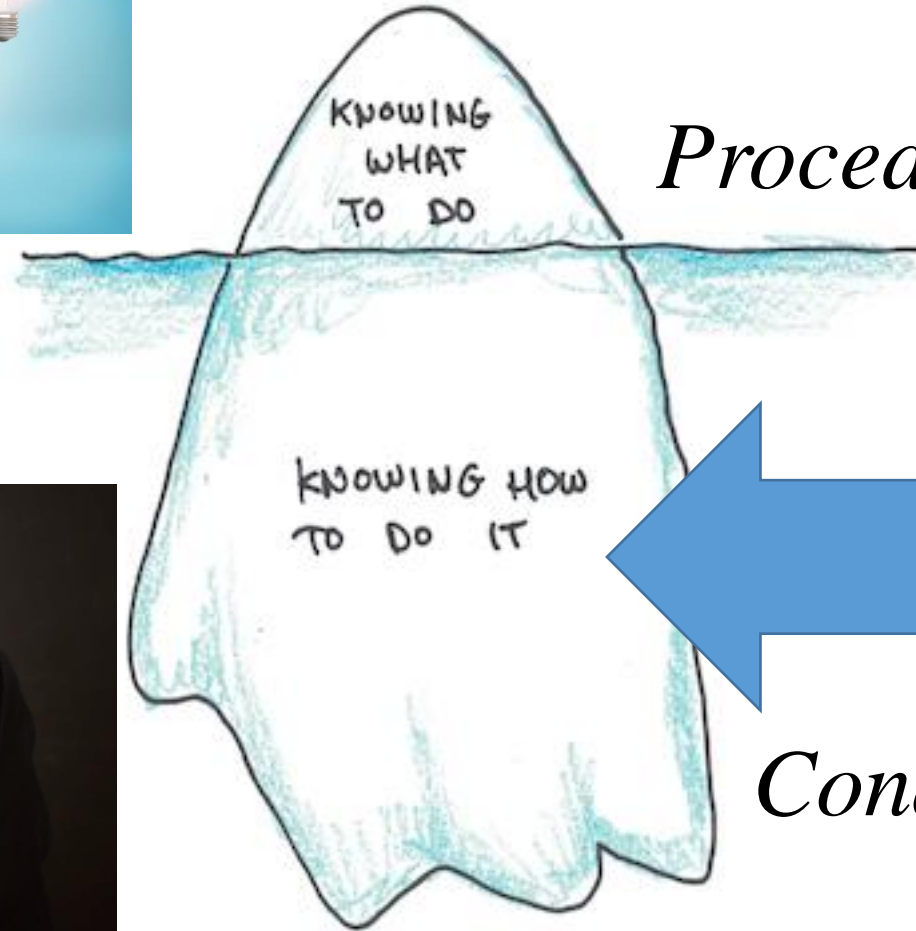
We can use a range of instructional approaches to help manage extraneous load, but intrinsic load is still an issue – and if we pack numerous practices into a course/program, we risk overwhelming our novices and they can end up not feeling confident with any or a small number of practices...





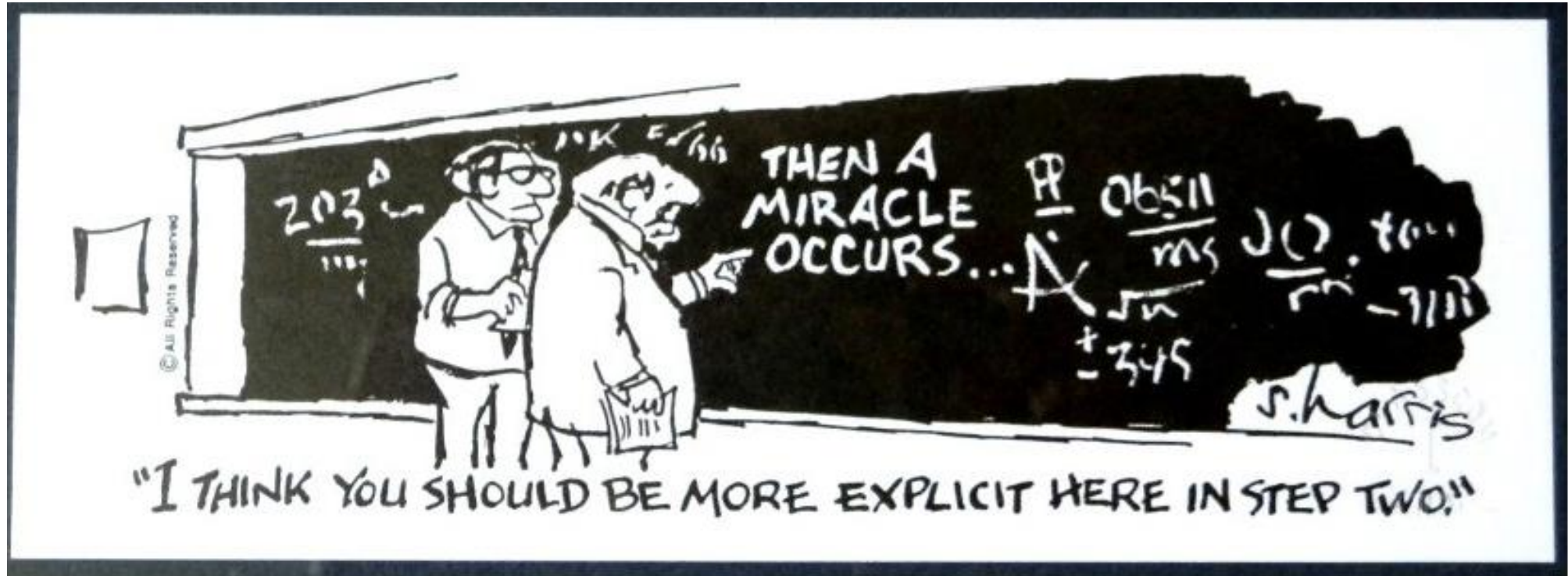
Declarative Knowledge

Procedural Knowledge



Conditional Knowledge





There is sadly no simple button



SEEMS LEGIT



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EXPERIENCE



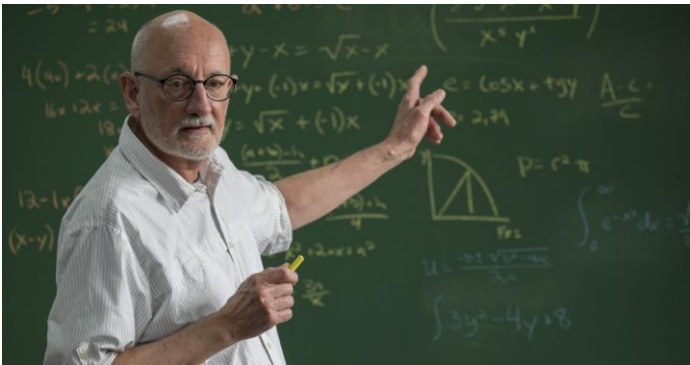
loading ...



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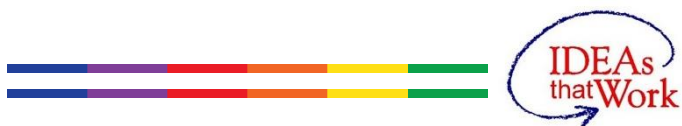
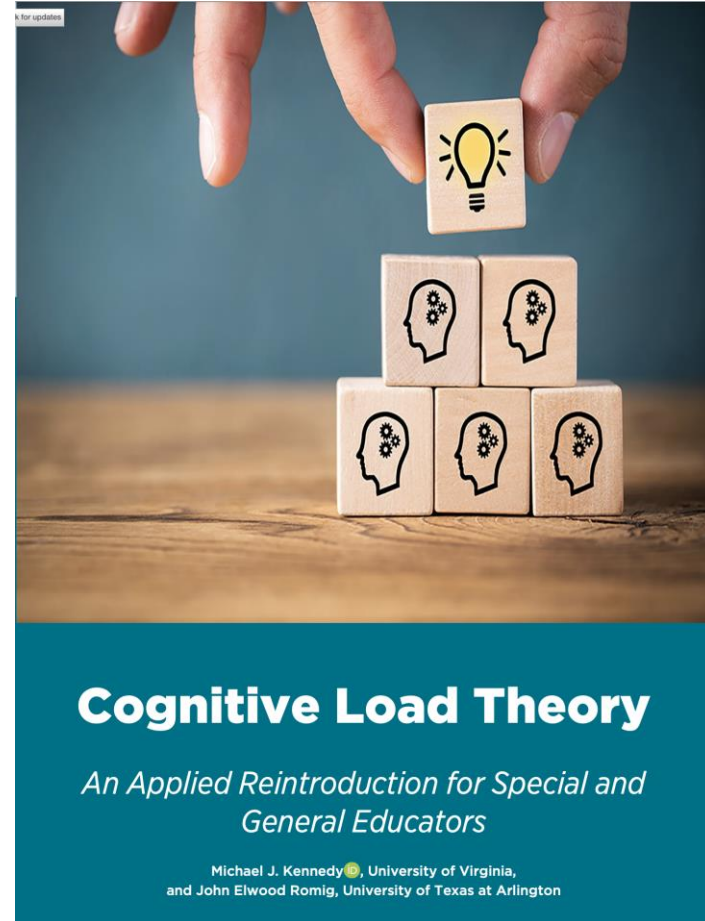


Supporting Students Through Investments in Your Practice: Come to the Bank of the HLPs



Teaching Exceptional Children

<https://journals.sagepub.com/doi/abs/10.1177/00400599211048214>



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Resource Spotlight

- Individuals with Disabilities Education Act (IDEA) website
 - Brings together IDEA information and resources from the Department and its grantees.
 - <https://sites.ed.gov/idea/>
- IDEAS That Work
 - For information from research to practice initiatives funded by OSEP that address the provisions of IDEA and ESSA. This website includes resources, links, and other important information relevant to OSEP's research to practice efforts.
 - <https://osepideasthatwork.org/>





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