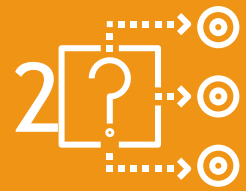
Metacognition

Thinking about thinking
Planning, Monitoring, Assessing
Teaching students how to learn more effectively

FSHS P&C TERM 2 – 8 June 2022

Learning Intentions



1. To understand the importance of metacognition and cognitive load for teaching practice and student performance
2. To establish a shared approach to helping students learn more effectively, including shared language and shared practices

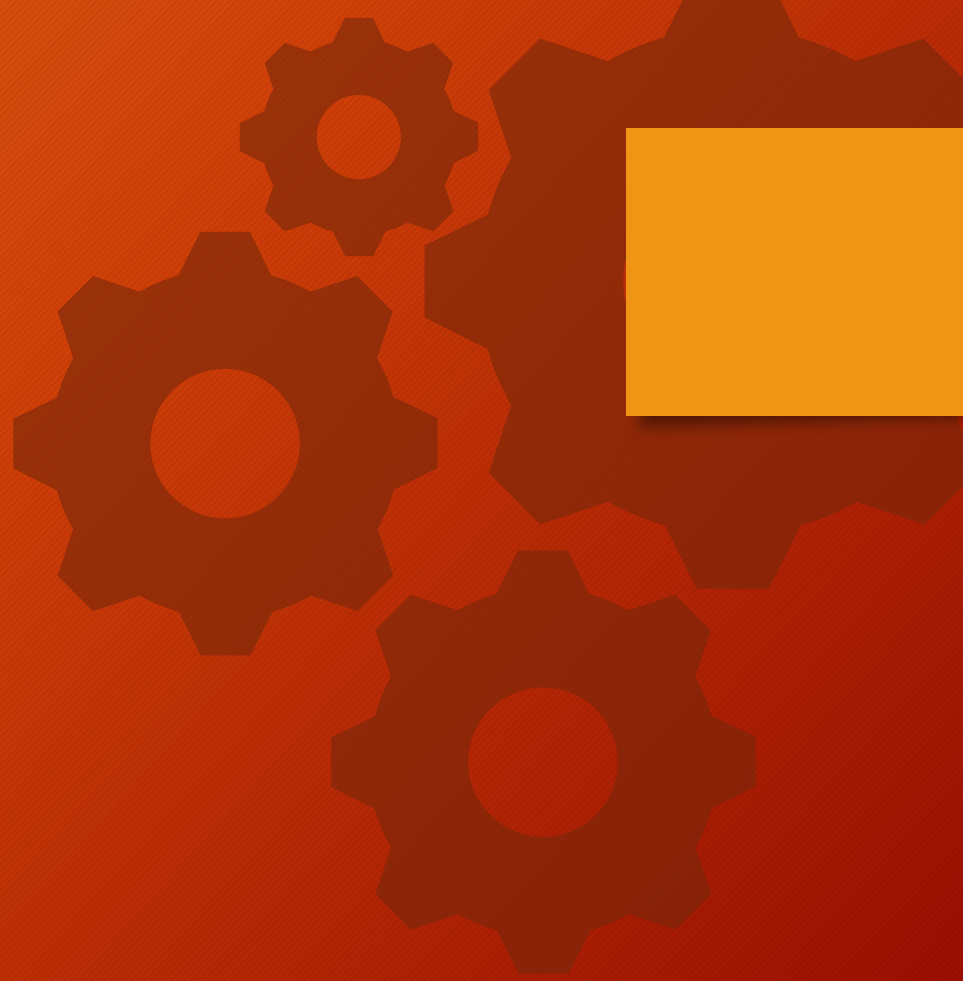
Metacognition

Thinking about your thinking.

Learning about your learning.

Evaluating your progress.

Critical self-analysis.



Learning and memory process

The learning and memory process has three essential stages:

1. Encoding: the initial learning of information
2. Storage: maintaining information over time
3. Retrieval: the ability to access information when needed

Learning and memory process

There are three main forms of memory:

1. Sensory memory
2. Working Memory (WM): stored very briefly, only seconds, and can only hold around 7 (+/-2) items of information at once.
3. Long Term Memory (LTM): stored for long time and can be in large segments

- WM is mostly stored and retrieved sequentially
- LTM is mostly stored and retrieved by association

XJGTYR

HYSIDHWGDXBU

INDEPENDENCE

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Working Memory Capacity

- CN
- NFB
- ICB
- SCI
- ANC
- AA

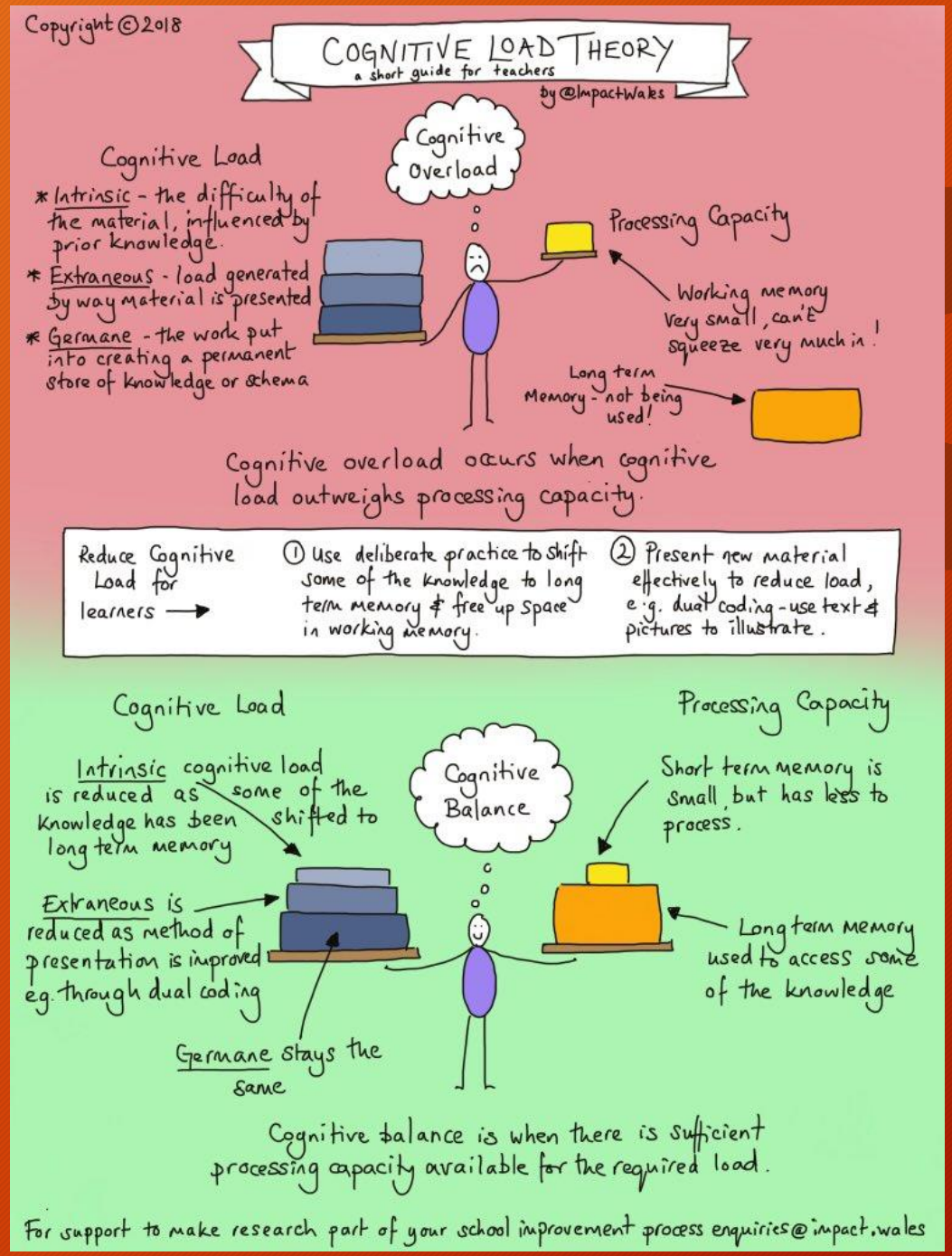
- CNN
- FBI
- CBS
- CIA
- NCAA

What is the significance of this to your students?

Facts matter. Information is important.

You need to commit critical information to your long-term memory to be able to perform better cognitively.

Teachers must help students store information in the LTM to manage cognitive load.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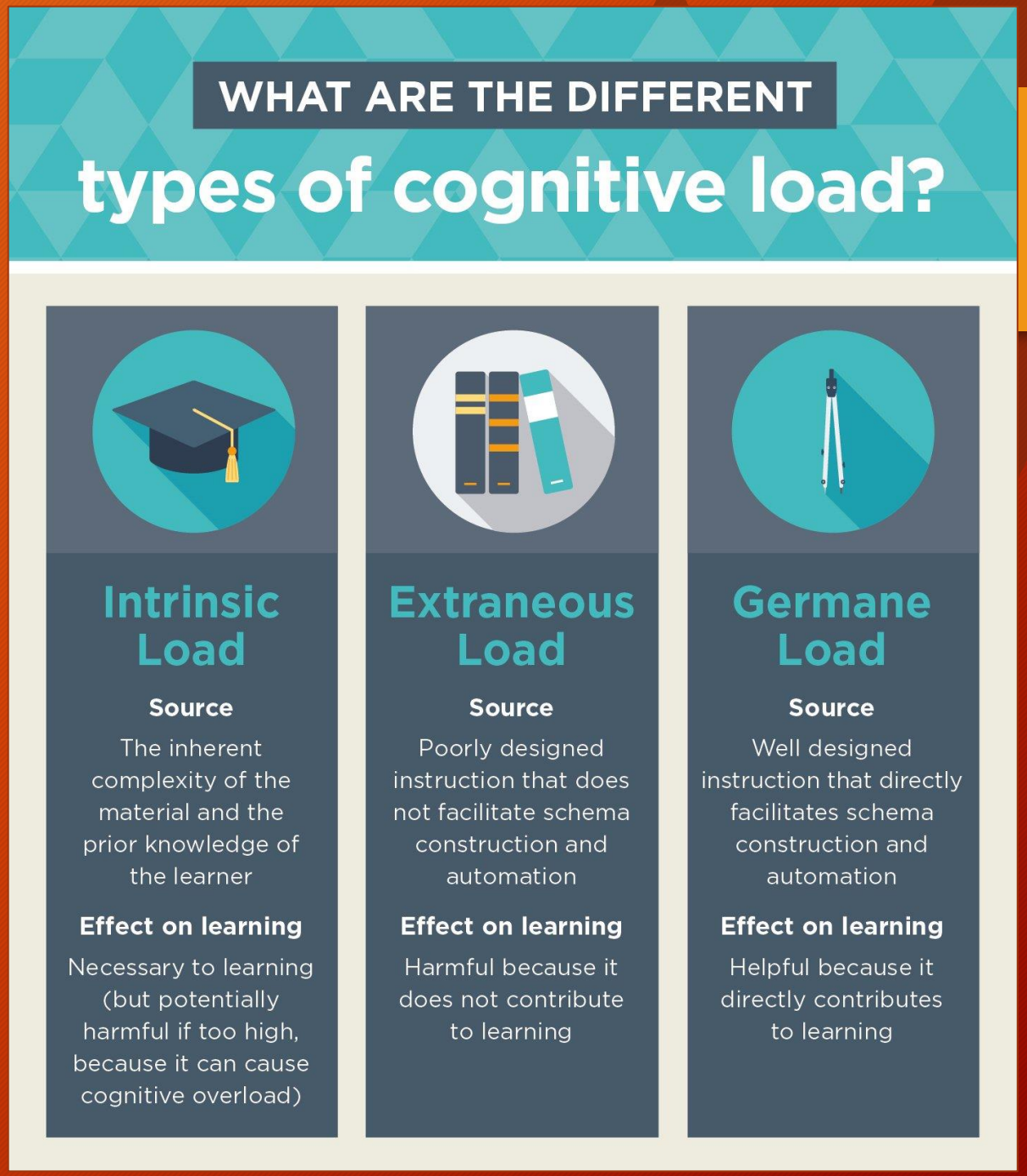
COGNITIVE LOAD THEORY
a short guide for teachers
by @ImpactWales
Cognitive Load
* Intrinsic - the difficulty of the material, influenced by prior knowledge.
* Extraneous - load generated by way material is presented
* Germane - the work put into creating a permanent store of knowledge or schema
Cognitive Overload
Processing Capacity
Working memory very small, can't squeeze very much in!
Long term Memory - not being used!
Cognitive overload occurs when cognitive load outweighs processing capacity.
Reduce Cognitive Load for learners →
① Use deliberate practice to shift some of the knowledge to long term memory & free up space in working memory.
② Present new material effectively to reduce load, e.g. dual coding - use text & pictures to illustrate.
Cognitive Load
Processing Capacity
Intrinsic cognitive load is reduced as some of the knowledge has been shifted to long term memory
Cognitive Balance
Short term memory is small, but has less to process.
Extraneous is reduced as method of presentation is improved eg. through dual coding
Long term memory used to access some of the knowledge
Germane stays the same
Cognitive balance is when there is sufficient processing capacity available for the required load.
For support to make research part of your school improvement process enquiries@impact.wales

Split-Attention Effect and Extraneous Load

"… if a geometry statement mentions Angle ABC, learners have to note the angle and find it on the diagram. Until the statement and the diagram have been mentally integrated, neither can make any sense. This activity has to occur in limited working memory and the sole reason it has to occur is because of the conventional format of geometry worked examples. If instead, the statements are placed on the diagram or had arrows indicating the relations between each statement and the diagram, the worked example is physically integrated and working memory resources do not have to be expended to integrate the two sources of information. Extraneous cognitive load is reduced and learning is facilitated." (Sweller)

This principle applies to the presentation of all information, as demonstrated by research of the split-attention effect in physics, music and computer education.



Importance of instruction and presentation to cognitive load

"A long, complex oral statement, because it is transient, will increase rather than decrease working memory load compared to a written statement, leading to the transient information effect and a reversal of the modality effect"

Sweller - Story of a Research Program

Helping your
gifted learner

Importance of instruction and presentation to cognitive load

“Most people assume that providing learners with additional information is at worst, harmless and might be beneficial. Redundancy is anything but harmless. Providing unnecessary information can be a major reason for instructional failure. ”

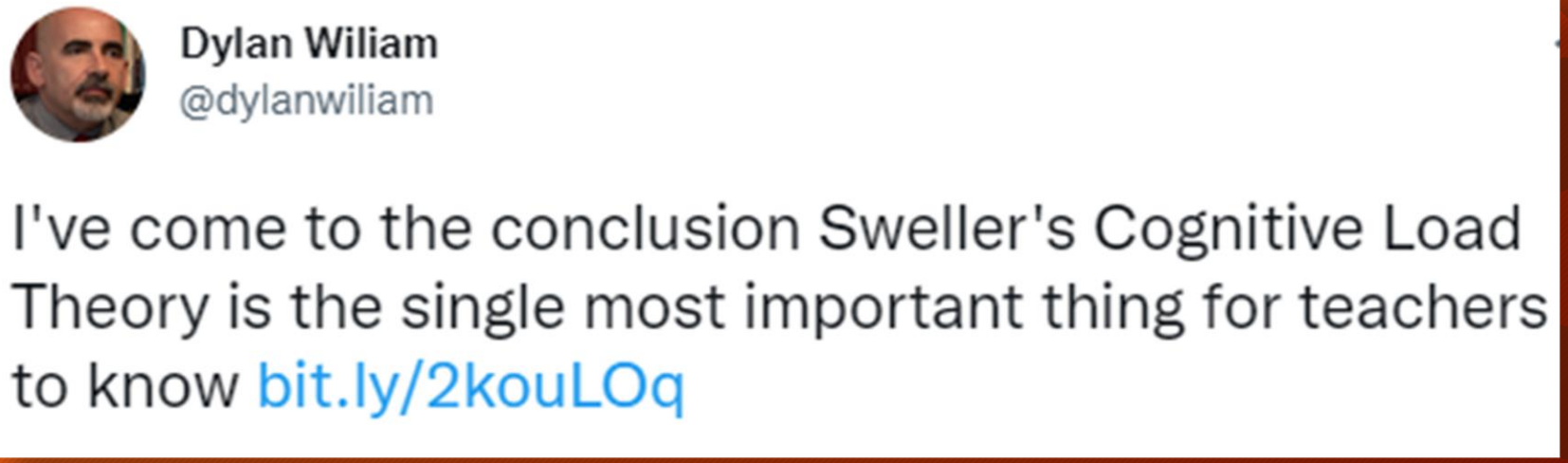
Sweller - Story of a Research Program

Managing cognitive load
Effective Instruction

- Paramount that instructional procedure reduces extraneous working memory load.

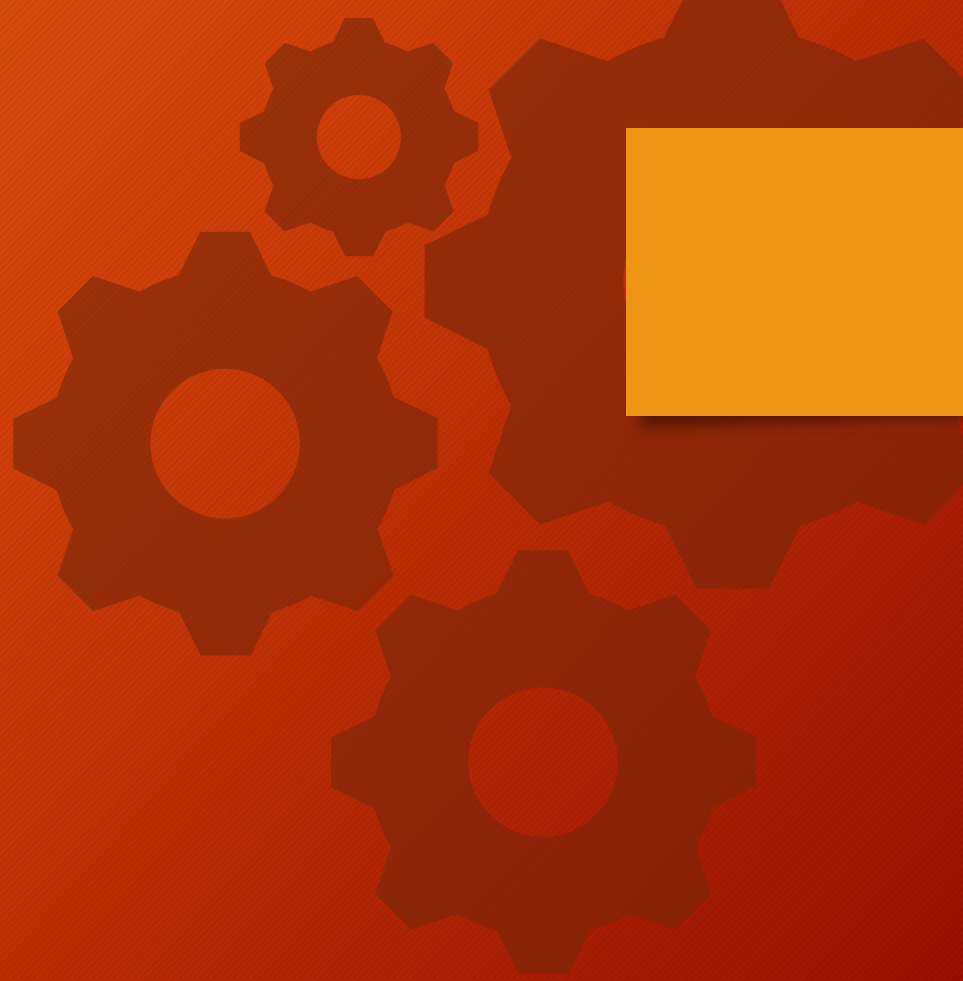
- Integrate text and diagrams where possible
- Don’t deliver new and complex ideas in a long, exclusively oral form (new and complex ideas should instead be delivered via written text so that students have a reference)

- Integrate speech with diagrams
- short & simple speech only (not long and complex – see above)
- use markers on diagrams (e.g. directional arrows)

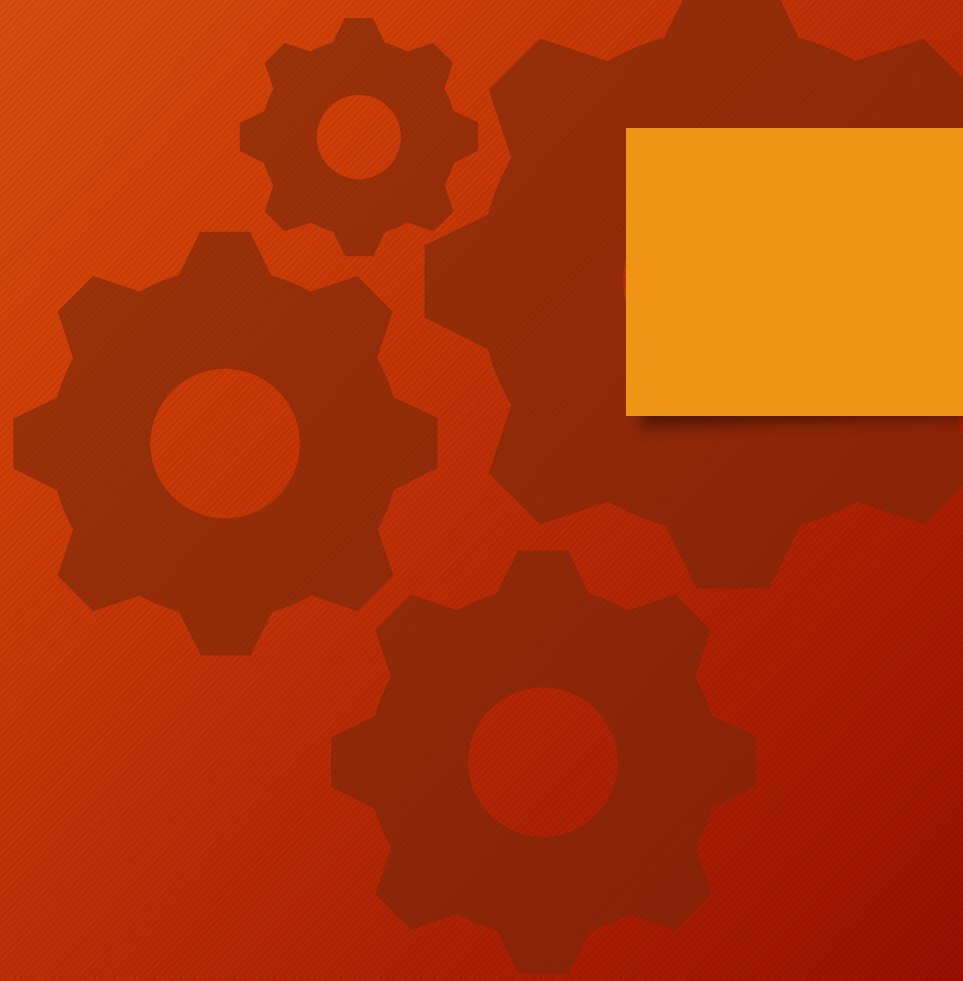

Dylan Wiliam
@dylanwiliam
I've come to the conclusion Sweller's Cognitive Load Theory is the single most important thing for teachers to know bit.ly/2kouLOq

Managing cognitive load
Better Instruction

- Students often do not know which parts of the teaching are important – teachers often assume that they do
- Teachers therefore need to be very explicit (e.g. discuss “big takeways” at the end of the lesson)
- Teachers are subject experts, students are subject novices
- Teachers tend to overestimate student knowledge (“the curse of knowledge”)
- Teachers therefore need to continually frame the teaching from the perspective of the novice
- This involves practices like scaffolding and chunking

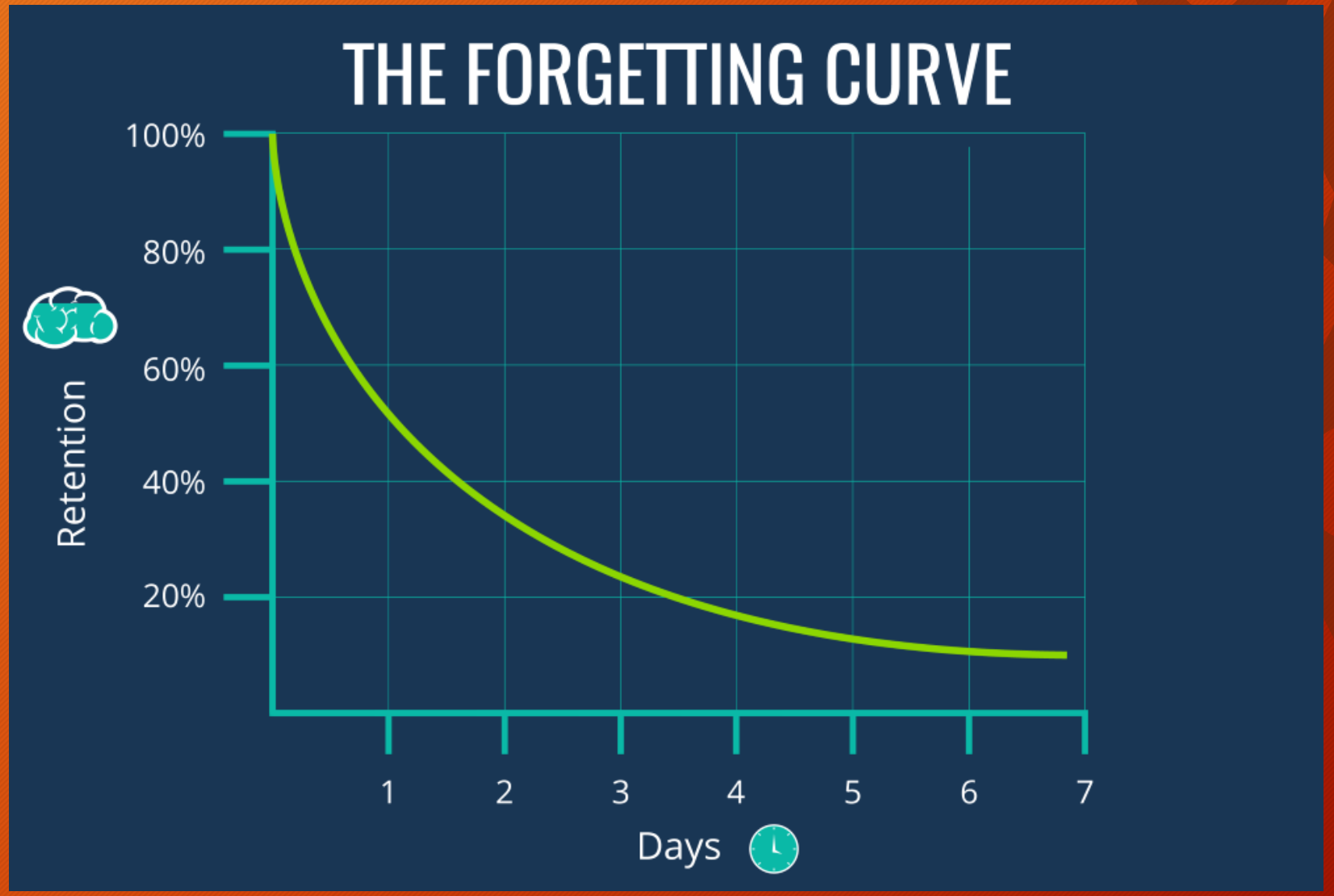


So, **how** do you remember and **what** should you remember?



Memory retention

- Memories fade very quickly, especially when the information is not accessed
- This is a form of memory failure known as transience
- It is represented by the “forgetting curve” devised by Ebbinghaus


THE FORGETTING CURVE
100%
80%
60%
40%
20%
Retention
1
2
3
4
5
6
7
Days

Memory retention

- The rate of decline in memory retention is able to be slowed
- The forgetting curve is flattened through active strategies such as review or revision, especially spaced, or memory strategies such as mnemonics, or elaboration

Retrieval Practices

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Tests

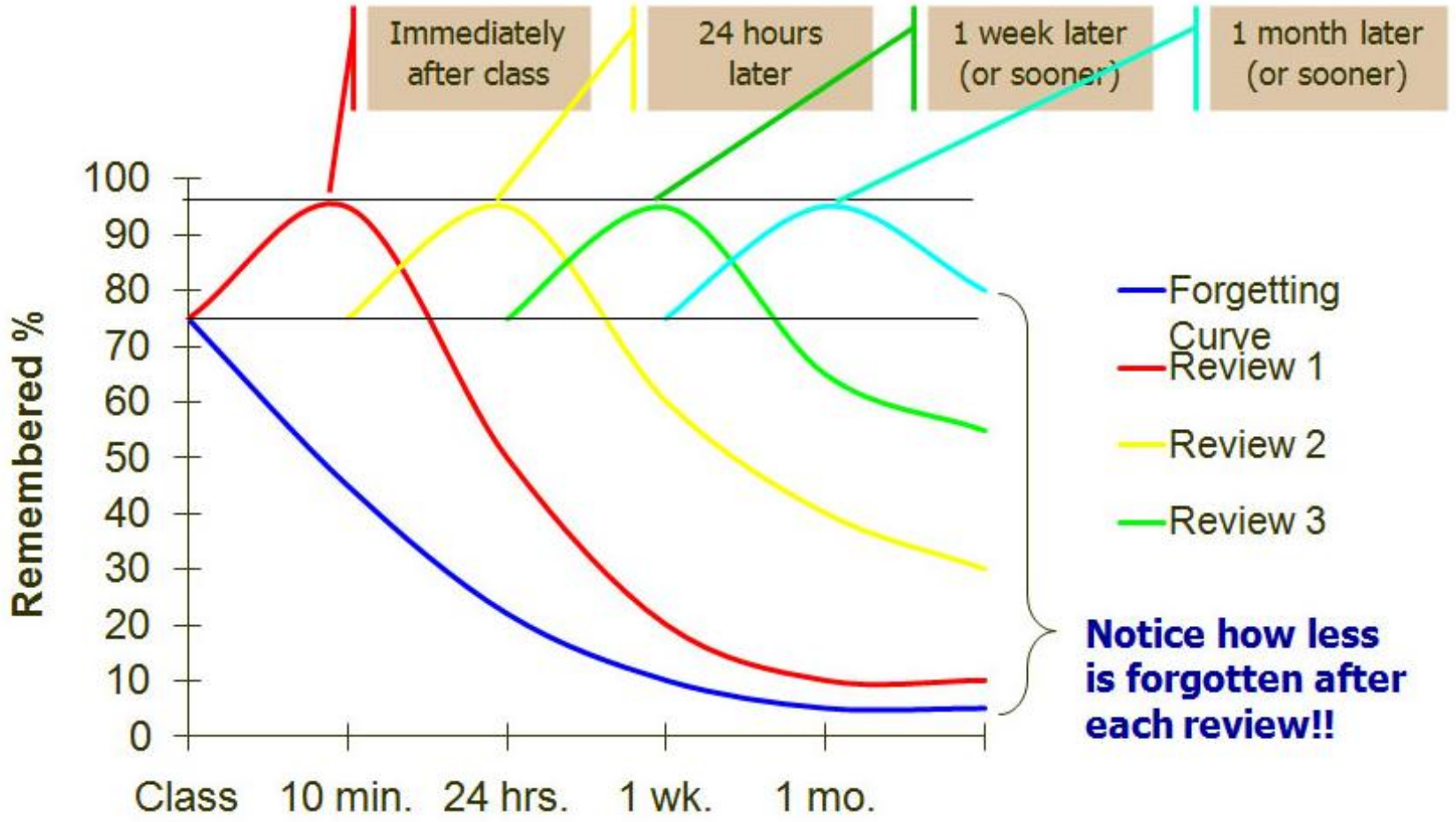
Worksheets

Revision activities

Retrieval Practices
What is it?

- Retrieval practice is the process of recalling past learning
- Sometimes called guided practice, explicit practice, mass practice, distributed practice, spaced practice and over-learning.
- Evidence-based
- Spaced = intervals

Overcoming the Curve



Retrieval Practices
Low stakes testing in the classroom

- Informal assessment. No marks = less anxiety
- Assessment as learning (as well as assessment of learning)
- Proven – “testing effect”
- Paper or digital quiz
- Less about what you use (the activity), but how you use it (the conditions)
- Enforce examination conditions – independently completed with no reference to stimulus (e.g. notes, textbooks)
- Spaced apart – revisit previous learning at intervals

Retrieval Practices
Other Activities

- Brain dumps - ask students to write everything they can remember about a topic or issue. Again, under exam conditions
- Entry/Exit Tickets (revision of past lessons)
- Question of the day
- Flashcards – Quizlet
- Quizzes – Kahoot

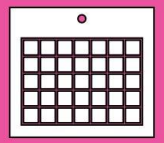
Retrieval Practice

Multiple Choice Questions

Mini White Boards

Self - quizzing

Retrieval Grids



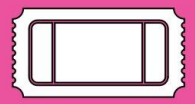
Free Recall

Online Quizzes

Verbal Recall

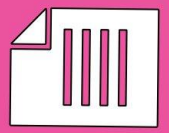
Knowledge Organisers

Entrance/Exit Tickets



Past Exam Questions

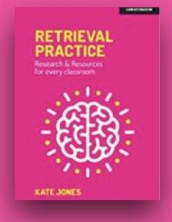
Flashcards



Revision Clocks

Spaced Practice

Elaboration



But what about outside the classroom?

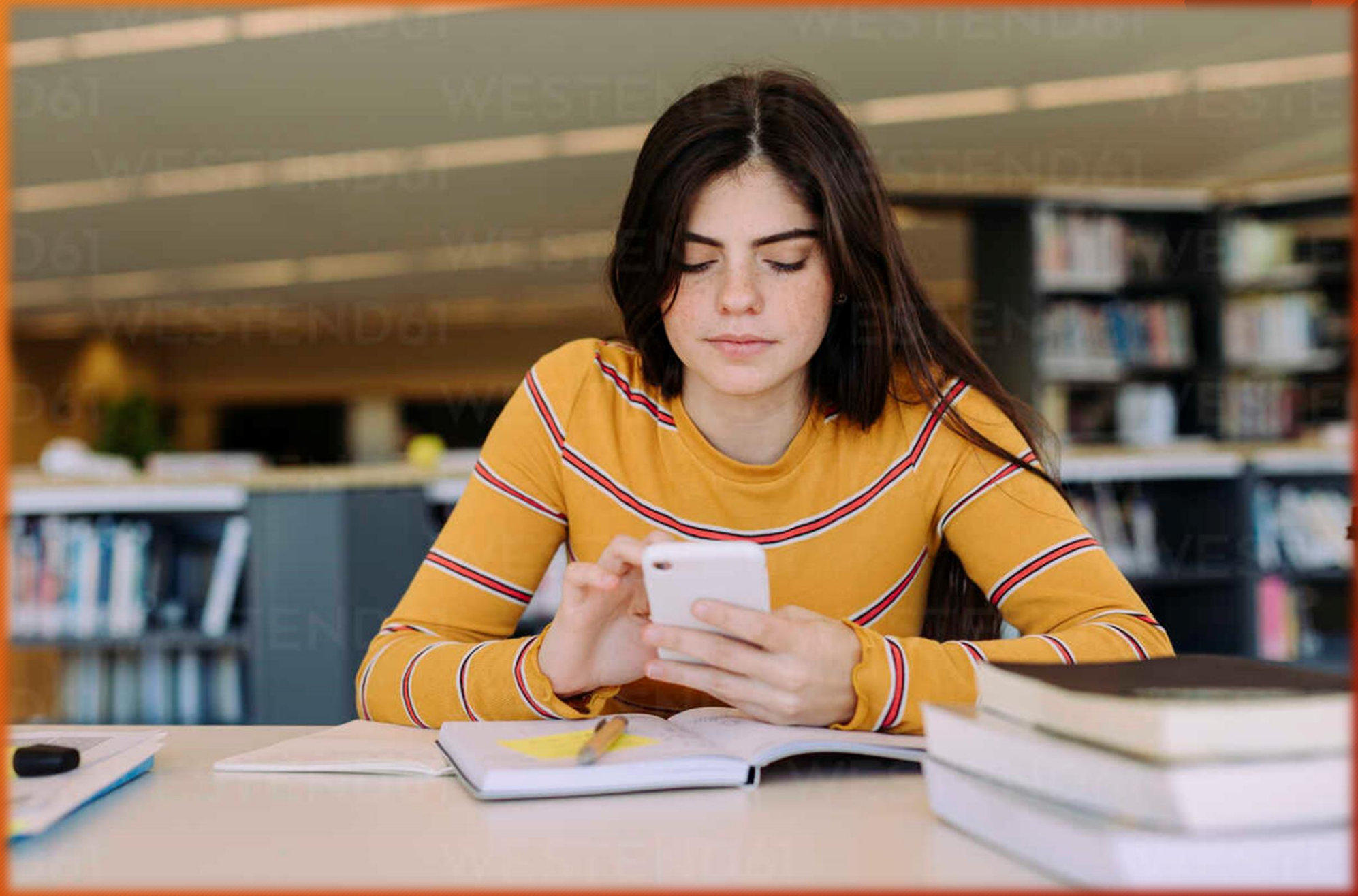
Students need to change their study habits

study

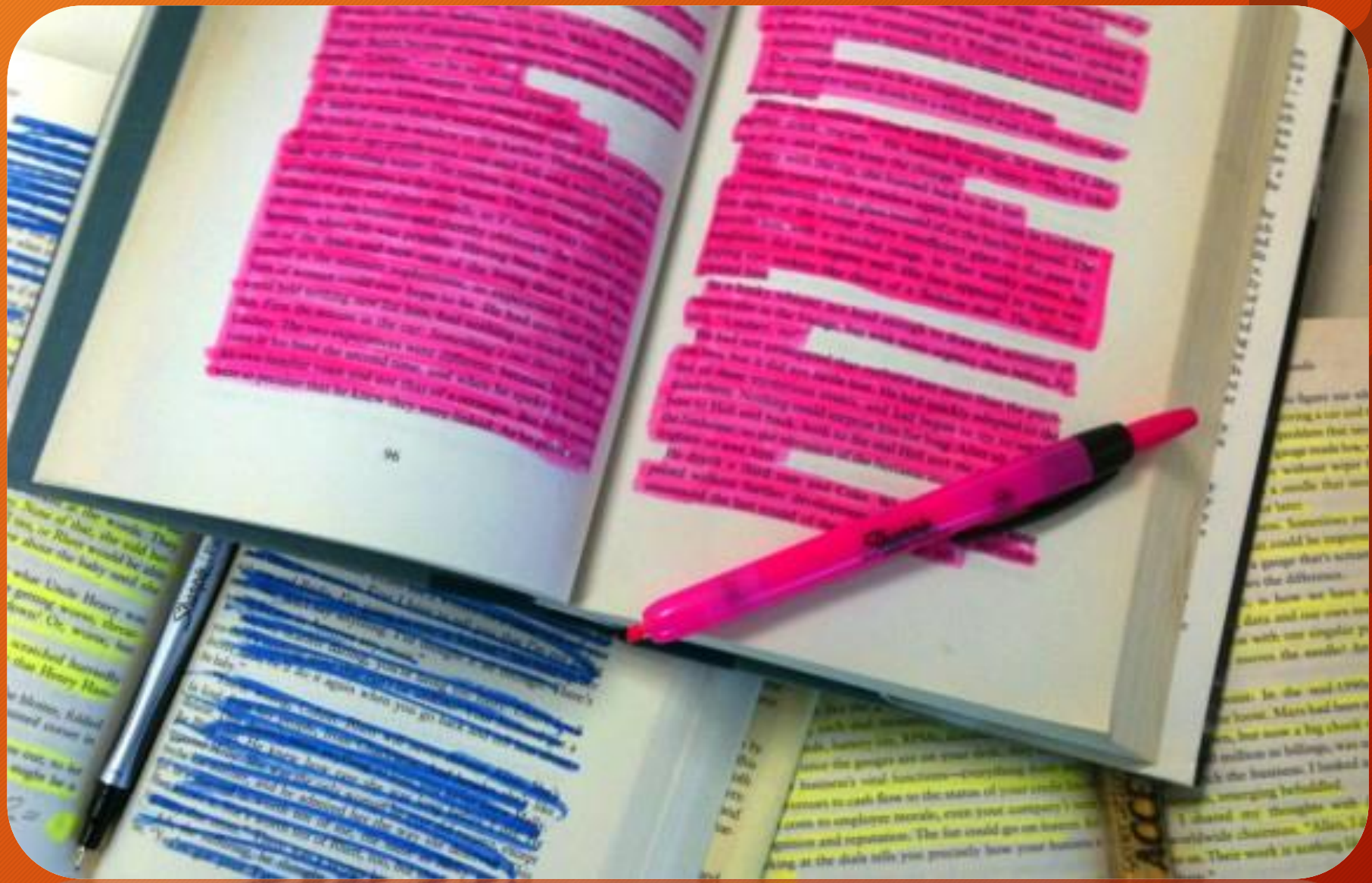
(verb)

The act of texting, eating and watching TV with an open textbook nearby.

bad study



also bad



Yes.
Also bad

ORIGINS/FEATURES

CULTURAL

Culture is a system of shared beliefs, values and customs that members of the group use to cope with their world and one another. It is passed down from generation to generation through learning

- Concerned with the traditions, way of life, values, artefacts and language of the country
- Focus on monarchy
- Little to no political agenda

e.g. Budi Utomo (Indonesia)

- Concerned about moral and political decline of Javanese due to Dutch colonialism
- Sought to educate Javanese to rediscover their culture and historical roots

e.g. Propaganda Movement (Philippines)

- Marked element of cultural nationalism with its emphasis on Tagalog literature and the arts, pre-Spanish history and self-conscious effort to seek out national personalities through newspaper publication

RELIGIOUS

Religion is a system of beliefs based on humanity's attempt to explain the universe and natural phenomena. They to some extent (a) require faith (b) seek to influence and organise the thoughts and actions of their adherents

- Concerned with indigenous religious practices, rituals and customs
- Little to no political agenda
- Can be spurred by religious revivalism in other parts of the world

e.g. Young Men's Buddhist Association (YMBA) (Burma)

- Sought to reform and modernise Buddhist beliefs and practices
- Buddhism was unprepared for intellectual issues associated with modernisation and foreign cultural presence

e.g. Muhammadiyah (Indonesia)

- Influenced by Reform Islam in the Middle East
- Aimed to modernise Islam by attacking heterodox religious practices and westernisation

TRADITIONAL

- Basic aims of restoring monarchy or traditional system of power, way of life
- Aimed to remove foreign presence, influence, ideas or systems
- No progressive social reforms to accompany it

e.g. Saya San Rebellion (Burma)

- Revived traditional, religious and political symbols of Burma and aimed to restore the monarchy

e.g. Communist Movement (Indonesia)

- Followed a doctrine that rejected the money [illegible] alien village structures or any external forms of authority
- Refused to pay taxes or attend public schools

STRONG PERSONALITIES

- Charismatic leaders with good oratorical skills are [illegible] mass support for the organisation
- Provided clear leadership in methods and organisation
- Often-times western educated
- Unifying force for various nationalist groups within the

e.g. Sukarno from the Indonesian Nationalist Party (PNI)

e.g. Tjokroaminoto from Sarekat Islam (SI)

IDEOLOGICAL

- Provided organisation, structure, methods and aims of movement

e.g. Communism

- Provided explanation of current situation and hope for [illegible] colonial masters
- Aimed to address rural grievances and large-scale revolts in
- Formulated ideals of a nation better than religious counterparts

e.g. Indochinese Communist Party (ICP) (Vietnam)

- Planned to overthrow French imperialism to make Indochina indep
- Planned to confiscate plantations belonging to imperialists and distri[illegible] poor peasants

e.g. Dobama Asiayone (Burma)

- Inspired by Socialism and Marxism

MODERN - MODERATE

- Modern ideals such as nationalism, communism, money economy, technology
- Moderate means willing to negotiate, accepts a slower pace of progress towards independence

e.g. Sarekat Islam (Indonesia)

- Founded on Muslim principles but later included liberalism
- Worked with Dutch government to protect economic interest of Muslims

e.g. Indonesian Nationalist Party (PNI)

MODERN - RADICAL

- Radical means willingness to use violent means, or wanting rapid and extreme changes

Retrieval Practices Homework

- Less emphasis less effective practices such as re-writing notes, re-reading the textbook and highlighting readings
- More emphasis on more effective practices such as tests and practice questions – anything that involves retrieving their learning

Retrieval Practices Interleaving

- Block or massed practice involves applying the same concepts (e.g. trigonometric formulas)
- Interleaving = mixed questioning (multiple topics)
- Highly applicable to maths
- HW sessions for students should utilise interleaving, either within or between subjects – diversified study = better retrieval practice

Memory Strategies

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Mnemonics

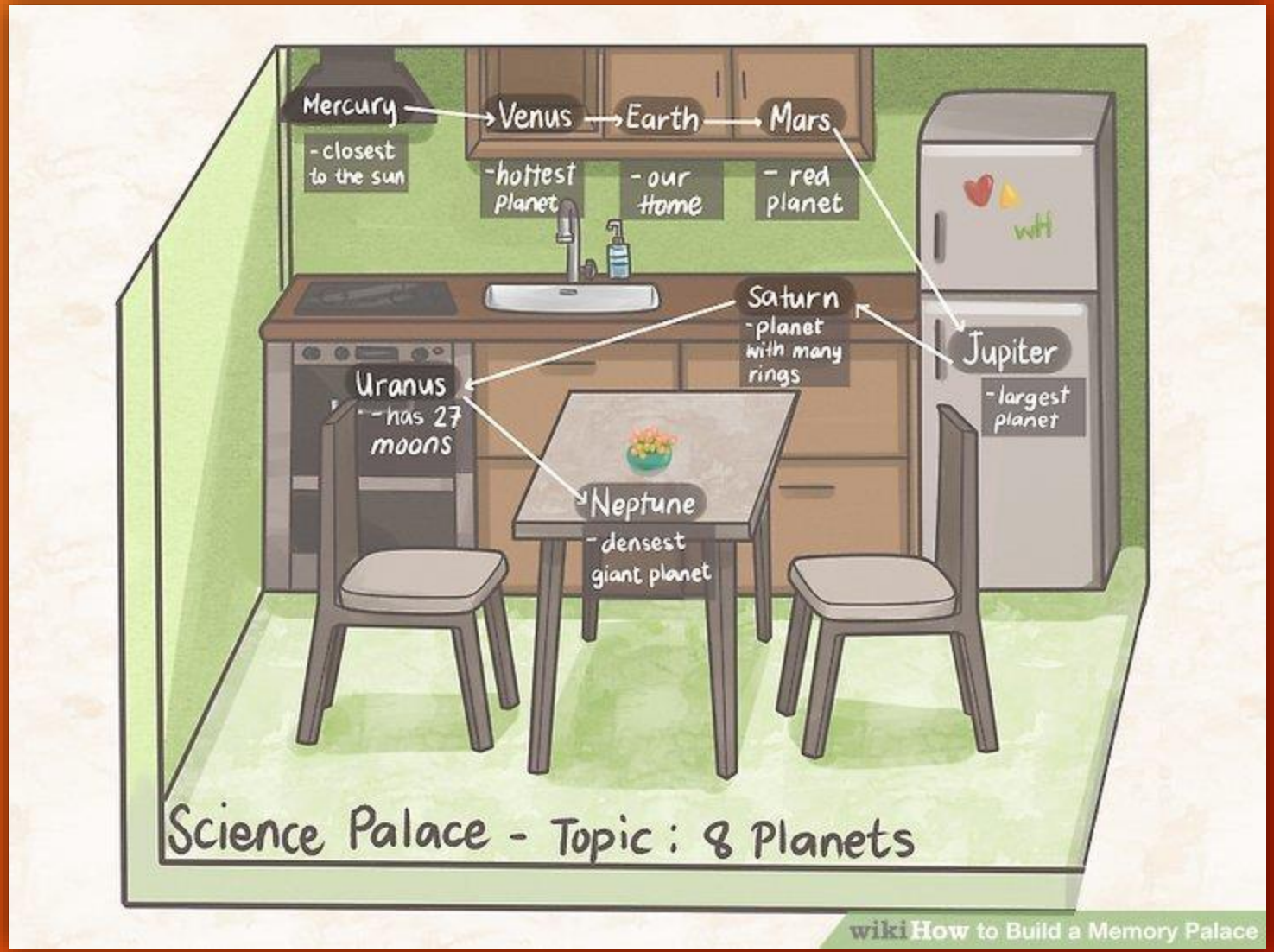
Mnemosyne
Ancient Greek goddess of memory

Memory Strategies Mnemonic

- Loci
- Chunking
- Acronyms and initialisms
- Rhymes
- Music (auditory)
- Keyword

Memory Strategies
Mnemonic - loci

- Method of loci
- Loci means place or location
- Otherwise known as “memory palace” – commonly involves using a home and its contents
- Images relate to places to make them more memorable


Mercury
- closest to the sun
Venus
- hottest planet
Earth
- our home
Mars
- red planet
Saturn
- planet with many rings
Jupiter
- largest planet
Uranus
- has 27 moons
Neptune
- densest giant planet
Science Palace - Topic : 8 Planets
wikiHow to Build a Memory Palace

Memory Strategies
Mnemonic - chunking

- Grouping individual items of information according to a system
- Hierarchical
- Functional

e.g. the number 1, 9, 6, 1 may be easier to remember as the year 1961

Memory Strategies
Mnemonic – acronyms and initialisms

- NESW
  - Never Eat Soggy Weetbix (cardinal points)
- BEESTOP (HSC Geography)
  - Biological
  - Ecological
  - Economic
  - Sociological
  - Technological
  - Organisational
  - Political

Memory Strategies
Mnemonic – rhymes

- Months of the year rhyme - “Thirty Days Hath September”
- Grammar rules - “i before e, except after c”

Memory Strategies
Mnemonic - music

- Alphabet song – Twinkle, Twinkle Little Star

Memory Strategies
Mnemonic - keyword

- “keyword mnemonic” is a memory-enhancing technique that incorporates identification of a keyword and the use of imagery to create a strong retrieval route
- Very effective for learning foreign language vocabulary

Keyword Mnemonic Strategy:
Foreign Language Vocabulary Learning

- Identify a familiar word (the keyword) within a target foreign word
- Create an interactive image between the keyword and the English translation of the foreign word.
- For example, a learner may see the Lithuanian word, *burna*, meaning mouth, identify an English keyword, *burn*, and then create an image of burning her mouth.
- Later, when the learner sees the word *burna*, she would identify the keyword, burn, recall the image she created, and reach the English translation of mouth