

Day 2

Recap - Day 1

- Why active learning?
- Active learning strategies such as PI, TPS, flipped...
- ICT tools to support active learning
- Mindful use of ICT tools

Reflection spot - Active learning strategies for your class

Now that you are familiar with various active learning strategies, which of these are you most likely to use in your classroom? Check all that apply

Post your response via this link -

<https://www.menti.com/alip1pr7x28>

Or go to [menti.com](https://www.menti.com) and type this code
7546 6442

[Responses](#)

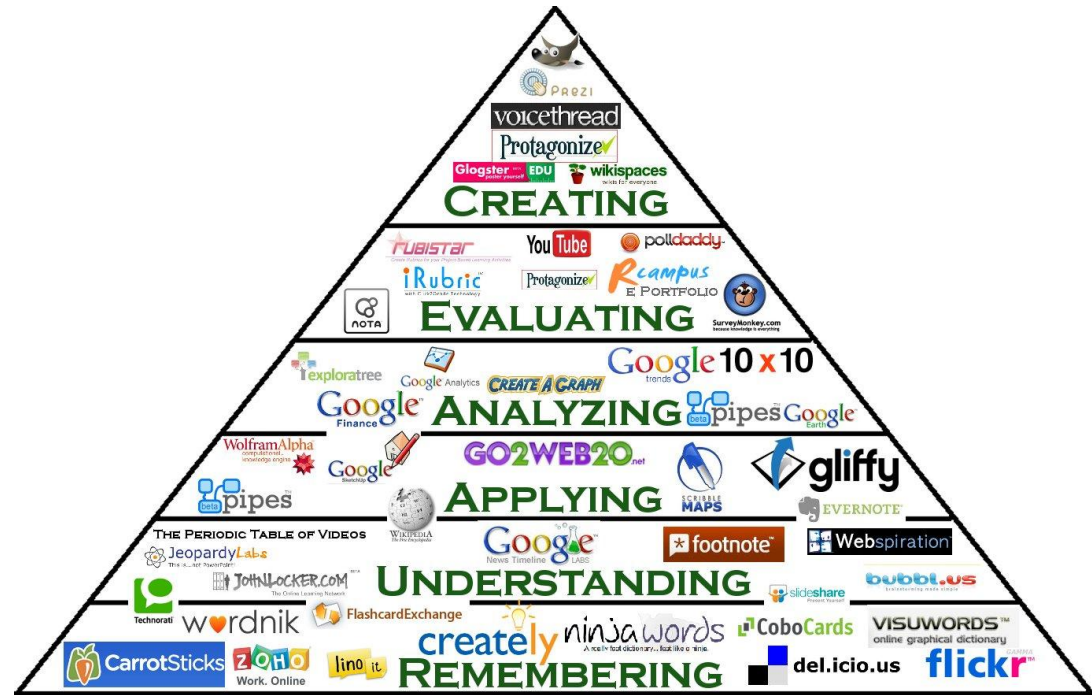


What are ICT Tools? Purpose?

ICT tools refer to **Information and Communication Technology** tools—digital tools and resources used to create, store, process, share, and communicate information.

Purpose:

- ICTs in Teaching and Learning
 - content creation
 - content delivery
 - collaboration
- Learner engagement
- Assessment
- Administration
- Research



Choosing ICT tools

Learning an ICT is not a big deal....important thing is...

How you choose it based on:

- Content
- Pedagogical purpose
- Context & Learners

Collaborative Discussion/Learning: - Piazza

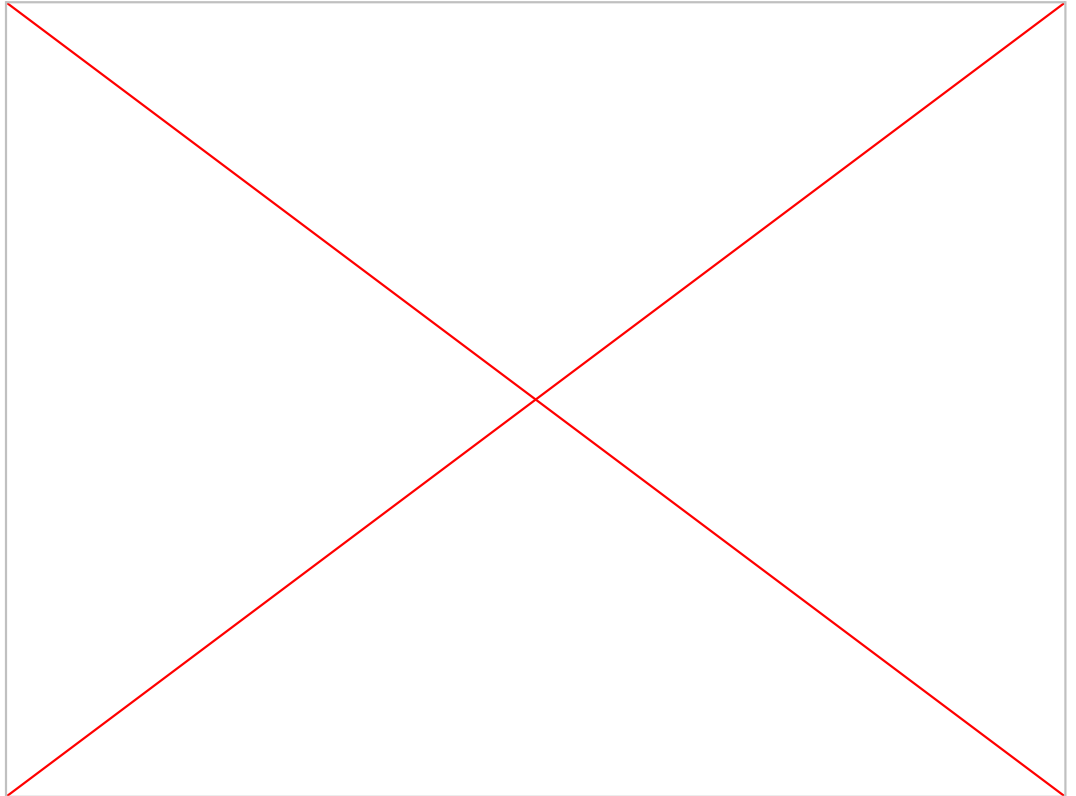
Piazza operationalizes principles of active learning by facilitating collaborative problem-solving, peer-to-peer explanation, and instructor-guided feedback—all within a socially constructed, student-centered learning environment.



Any volunteers want to setup Piazza for your upcoming course?

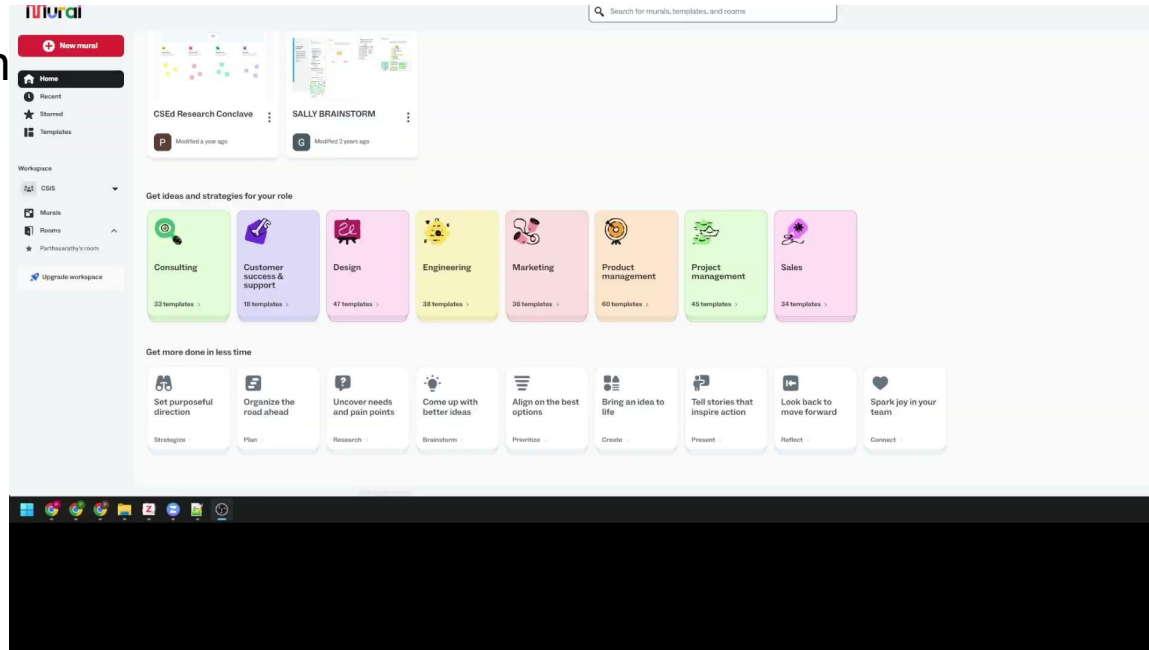
PBL Approach: - Trello

Trello is a project management tool but could be used for managing our TO-DO's or tracking student projects, facilitating topic wise or weekly async collaboration between groups of students. It can also be used to monitor student progress in a structured project. This is a PAID tool. Github projects is a free alternative to trello.



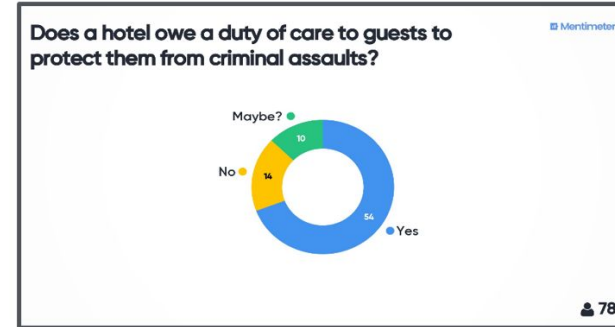
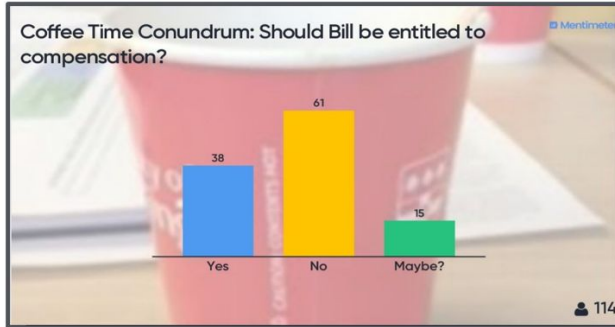
Mind Mapping Tools: - Mural

Mural is a digital collaboration platform, often described as an online whiteboard, that helps teams brainstorm, plan, and execute projects visually. It provides a shared, interactive space for teams to work together, regardless of location, using features like sticky notes, diagrams, and real-time feedback mechanisms.



Mentimeter

<https://www.mentimeter.com/>

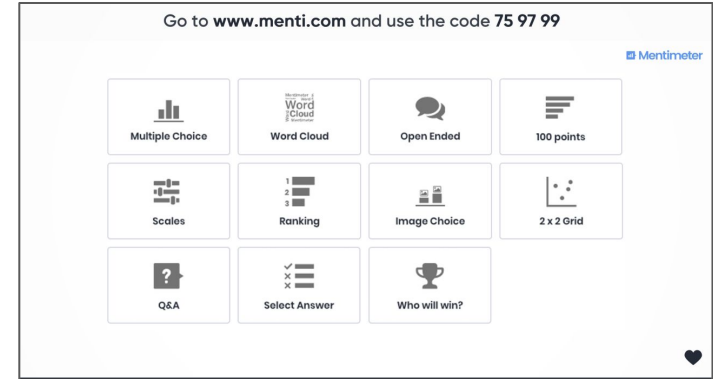


Choosing ICT tools + Rationale

Affordance + Rationale

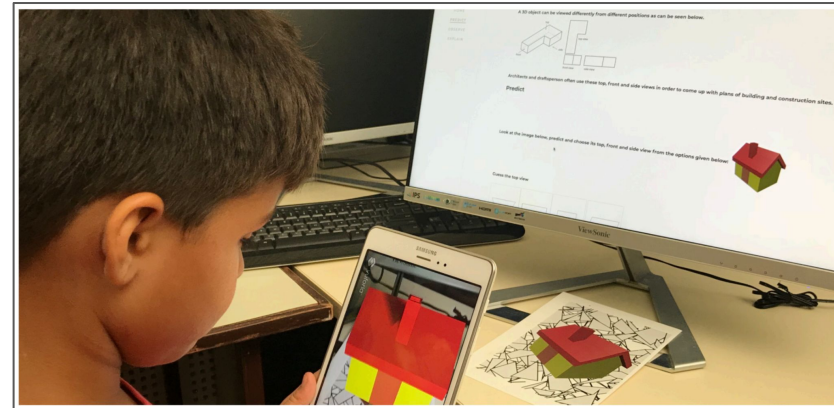
E.g., Using Mentimeter

- To check learners prior knowledge
- “why to diagnose learner's prior knowledge?”
- “what do you do with this?”



E.g., Augmented Reality

- **Affordances:**
 - Interactive and Immersive, 3D representations
- **Rationale:**
 - Chemistry: Making invisible visible
 - Geometry - Visualization of 3D geometrical shapes



Choosing ICT tools - Takeaway

ICT tools provides a variety of affordances....

But, we should be cognizant about the following aspects:

- Content - Nature of content
- Pedagogical purpose - what is the pedagogical purpose?
- Context & Learners - access, who are your learners?

Day 2: Deliverables

- Nine groups identified
 - Sit your groups, discuss but document individually
- Scaffolded support document available at
 - <https://tinyurl.com/FDevPDay1>
- Groups can remain same for all the days.
- 4th July → Everyone present their plan of their revamped courses.
 - Including current approach, revamped approaches, rationale, how success will be measured etc. for 10 minutes each.



Attention Span and Cognitive Load

Outline - Attention span and Cognitive load

- Methodology/Approaches
 - CLT Theory
 - Multimedia principles
- ICT Tools
 - E.g., Using visualisation tools effectively
 - Techniques to manage attention span

Why understand attention span and cognitive load?

Memorize these numbers - 10 seconds only:

3 1 2 8 6 7 0 2 8 5 7 4

Why understand attention span and cognitive load?

Now memorize these numbers – again **10 sec** only:

1 9 4 7 1 8 5 7 2 0 1 7

Why understand attention span and cognitive load?

Sequence A - 3 1 2 8 6 7 0 2 8 5 7 4

Sequence B - 1 9 4 7 1 8 5 7 2 0 1 7

What happened?

Which was easier? Why?

Why understand attention span and cognitive load?

Sequence A - 3 1 2 8 6 7 0 2 8 5 7 4

Sequence B - 1 9 4 7 1 8 5 7 2 0 1 7

Sequence B includes **repeated patterns** like 1 9 4 7 and 1 8 5 7 (note role of cultural and semantic knowledge - India), and repeating digits like 1 9 - 1 8 - 2 0 and the number 7.

Sequence A is more **random** and lacks obvious patterns, making it harder to store in short-term memory.

Why this matters?

This kind of exercise shows how our **working memory favors**:

- Chunking (e.g., remembering 1947 as a year),
- Repetition, and
- Meaningful associations.

These principles are widely used in educational design to make information easier to learn and recall.

One such principle...

Working memory is limited.

- Working memory can hold only 7 ± 2 “units” (Miller, 1956)
- Anything more – “cognitive overload”

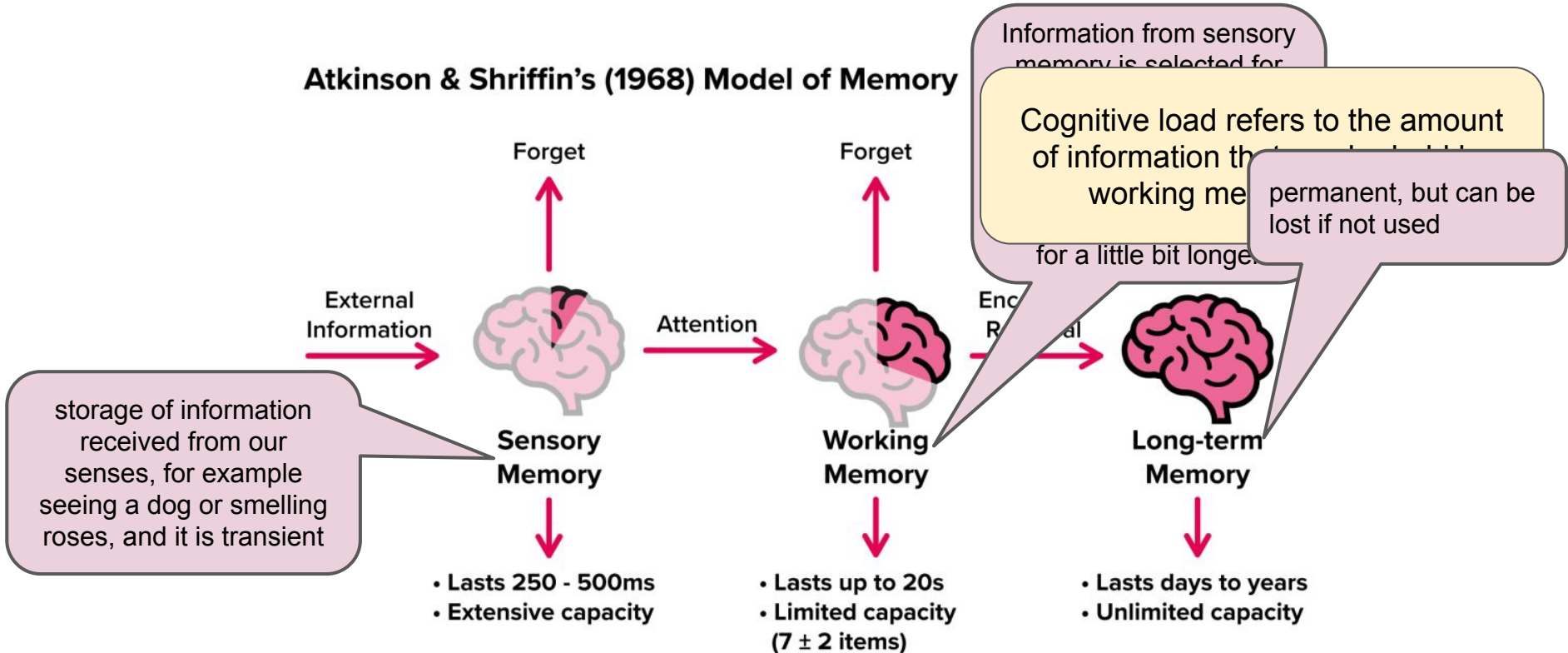
How people learn?

We'll examine features of the human cognitive model, especially memory.

- First overview
- Then series of activities to look deeper into features

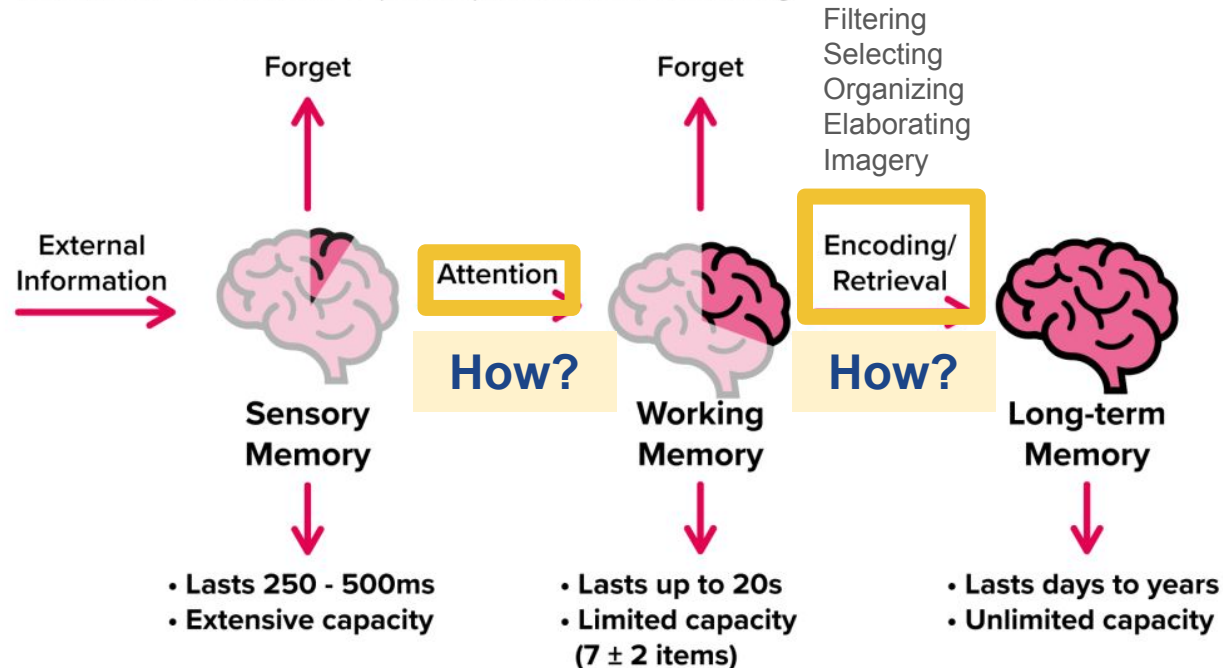
Overview of cognitive memory model

Atkinson & Shiffrin's (1968) Model of Memory



Overview of cognitive memory model

Atkinson & Shrifin's (1968) Model of Memory



Cognitive model - Memory

Learning is encoding information into memory.

- Encoding begins with attention
- Application ensures transfer into memory
- Practice reinforces retention, aids recall

The above model is called the Atkinson-Shiffrin memory model.

Read for example: http://en.wikipedia.org/wiki/Atkinson-Shiffrin_memory_model,

Also see: <http://en.wikipedia.org/wiki/Memory>

Cognitive model feature - working memory

Working memory is limited.

- Working memory can hold only 7 ± 2 “units” (Miller, 1956)
- Anything more – “cognitive overload”

Can increase memorization capacity by chunking - group in smaller pieces of information into a larger, meaningful unit.

Activity 2

Look at the painting below while reciting the numbers **1-10** in your head.



Activity 2

What did the painting contain?

Activity 2 (contd)

Read the text below while reciting the numbers **1-10** in your head

"I see that you came on the train this morning, " said he. The lady was amazed, and looked in surprise at my friend. "There is nothing strange, it is in fact elementary" my friend said with a smile. "There is dirt on the left arm of your jacket. I can see that it came there this morning. I think it happened when you were going to the station. I can also see a part of a ticket in your glove, so I know that you went on the train."

Activity 2 (contd)

What was the story about?

Activity 2

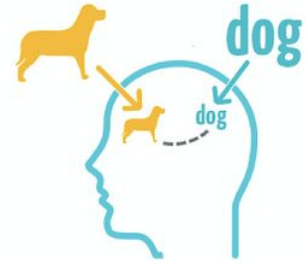
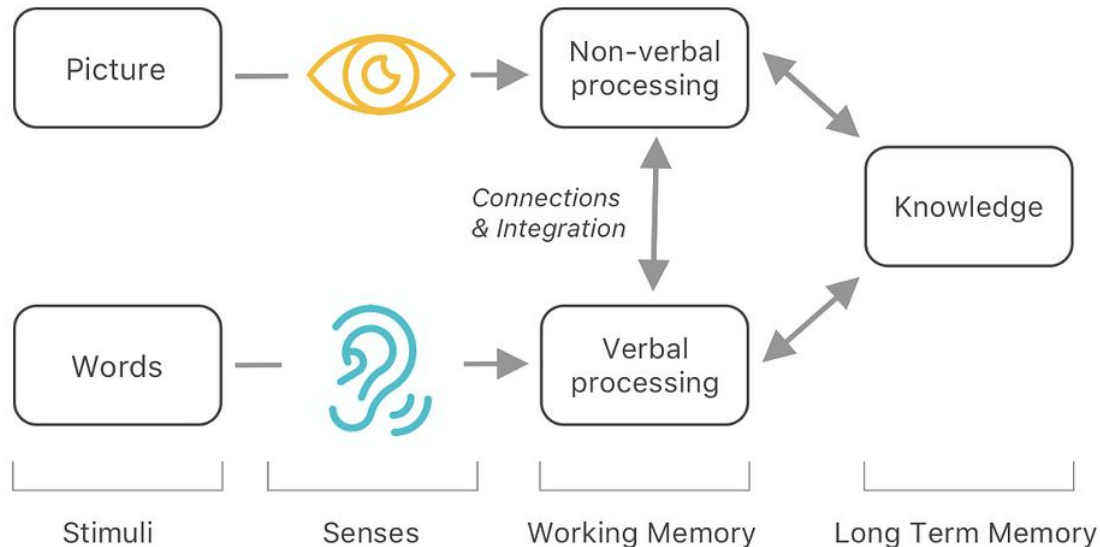
So what happened?

Much easier to answer what the painting was about.

Cannot even pay attention to story and counting simultaneously.

Cognitive model feature - 2 channels for information processing

Working memory has distinct **visual** and **verbal** channels of information processing (**dual coding theory**)



Implications for two channel feature

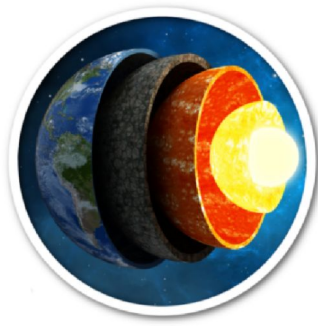
DISCUSS

Implications for learning ?

Implications for two channel feature

Implications for learning ?

- Combine Verbal and Visual Information
- Present concepts using both text/audio and images/diagrams.



The Earth has 4 layers.

The outermost layer is the crust. This is the rocky layer that we live on.

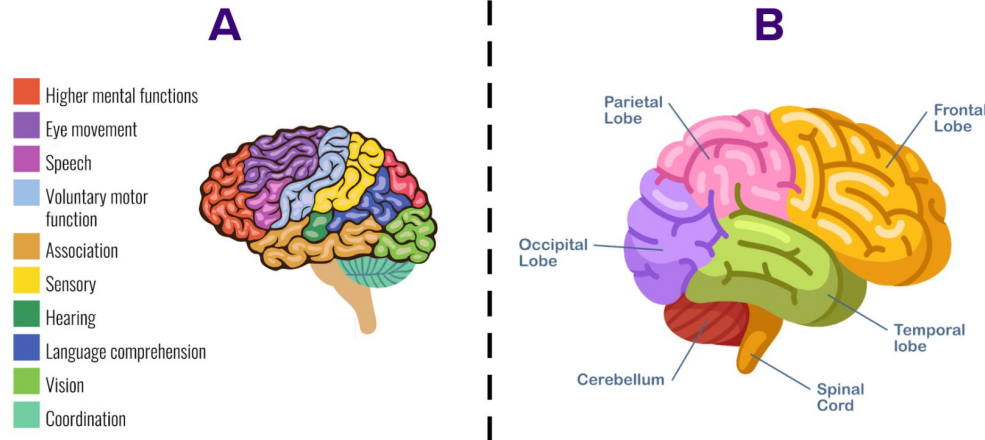
Below this is the mantle, which is made up of magma, molten rock.

We then have the liquid outer core and solid inner core. These are both mostly made of iron.

Implications for two channel feature

Implications for learning ?

- Integrate Text and Visuals Meaningfully
 - Place related visuals and text close together; avoid split attention.



Cognitive model - long term memory

How does a child learn to speak a language?

- In spite of significant mimicry, new sentences are constructed, stitched together like a quilt.

Activation of information in long-term memory is **productive**, created on the spot from small, stable parts.

Long term memory response is productive (created, active).

Connection between working memory and long-term memory

- Working memory does not function independently of long-term memory. The **interpretation** and **understanding** of items in working memory depend on their **presence** and **associations** in long-term memory.
- Information in long-term memory is **not immediately accessible**, using information from long-term memory requires that it be **activated** (brought into working memory).

Activity 3

QUESTION: This set of four cards satisfies the property that if there is a vowel on one side of the card, then there is an odd number on the other.

How many cards do you need to turn over to be absolutely certain that the cards have been correctly chosen to satisfy this property?

J

2

E

3

Activity 3

You are the manager of a restaurant that serves coffee but also alcoholic drinks to students of legal drinking age (21 in the US). Rather than standing at the door checking IDs all the time, you have occupied a table so you can do some work. When patrons come in and give their order, the waiters bring you card with the patron's order on one side and their best guess of the patron's age on the other (assume the waiters can guess accurately). You then decide whether to go and check IDs.

How many cards do you need to turn over in order to decide whether to check the patron's ID?

16

coke

45

beer

Most people answered: Two. We need to turn over 16 to make sure that the side is not an alcoholic drink, as well as Beer, to make sure age > 21.

Cognitive model – long term memory

Long term memory is context-dependent.

(Mostly) Easier to answer questions in relevant contexts.

Cognitive response to a mental stimulus depends on:

1. the external situation
2. the way in which the stimulus is presented and
3. the state of the respondent's mind when the stimulus is presented

Summary - Cognitive model

Working memory

- limited (7 plus/minus 2 items)
- two distinct channels – verbal & visual
- short term

Long term memory

- Productive
- needs activation, ie brought into working memory (to be useful)
- context dependent
- associative – schema, robust mental models
- Holds a huge amount of information—facts, data, and rules for how to use and process them

Connection between working memory and long term memory

Types of cognitive load

Intrinsic load: **Inherent** to the material being learned or the task being performed.

- It is **unavoidable**, but can be managed through **strategies** like sequencing, scaffolding, and chunking content.

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Germane load: Refers to the **productive mental effort** used to construct and refine mental models (knowledge structures).

- This load is essential for deep learning and meaningful understanding.

Effective instruction must...

MANAGE



Intrinsic
Load

MINIMISE

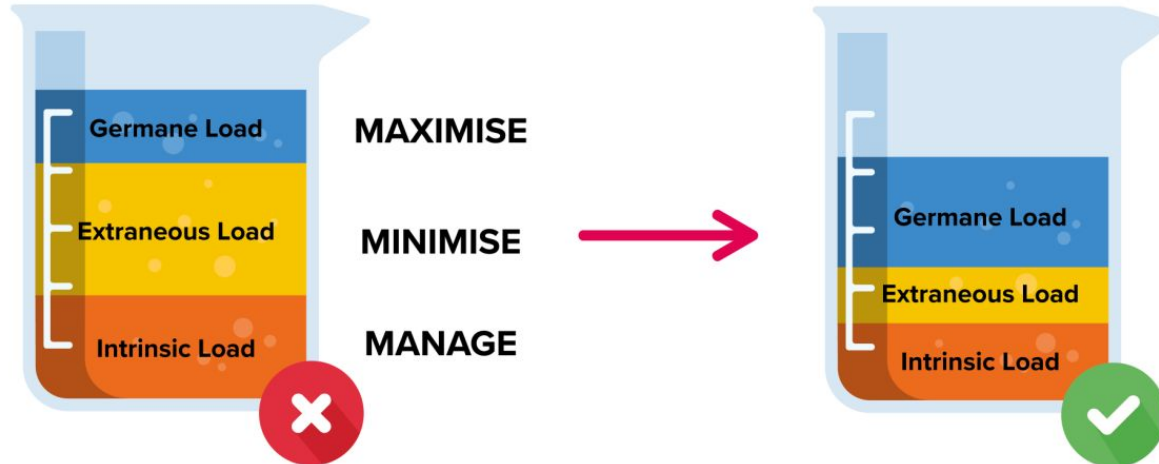


Extraneous
Load

MAXIMISE



Germane
Load



How? Multimedia principles (Meyer)

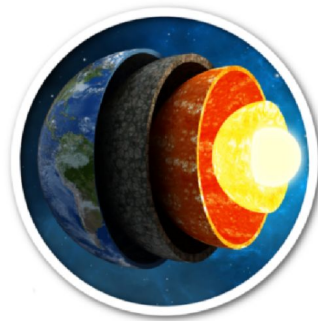
Multimedia Principles (Meyer) are practical guidelines grounded in **CLT** to optimize learning through multimedia design.

How?

- **Reduce** Extraneous Load (e.g., multimedia, coherence, redundancy, spatial/temporal contiguity)
- **Manage** Intrinsic Load (e.g., segmenting, modality)
- **Foster** Germane Load (e.g., signaling, personalization)

Multimedia Principle

Include both words and graphics.



The Earth has 4 layers.

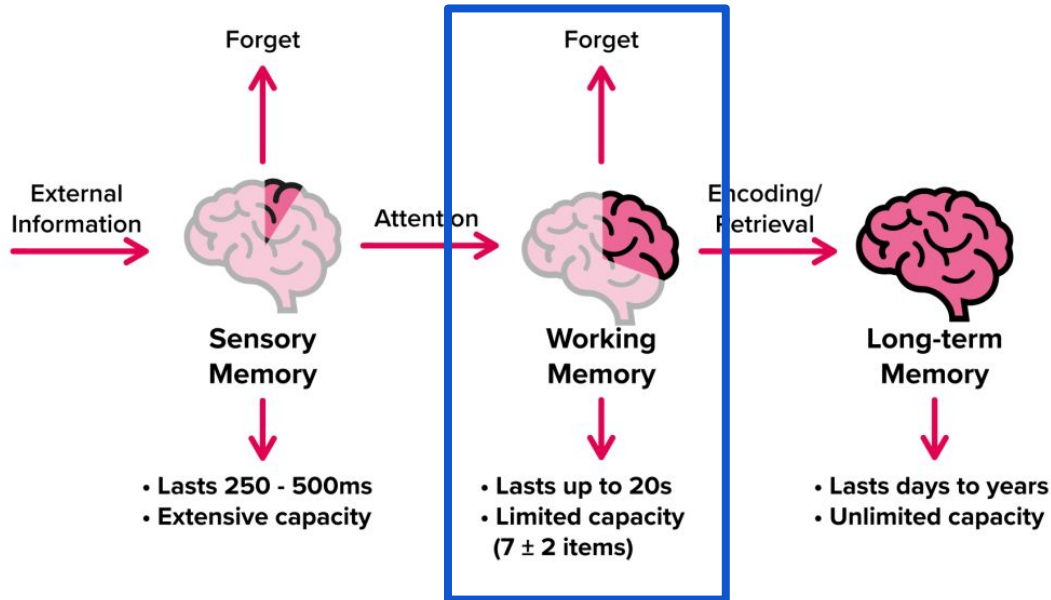
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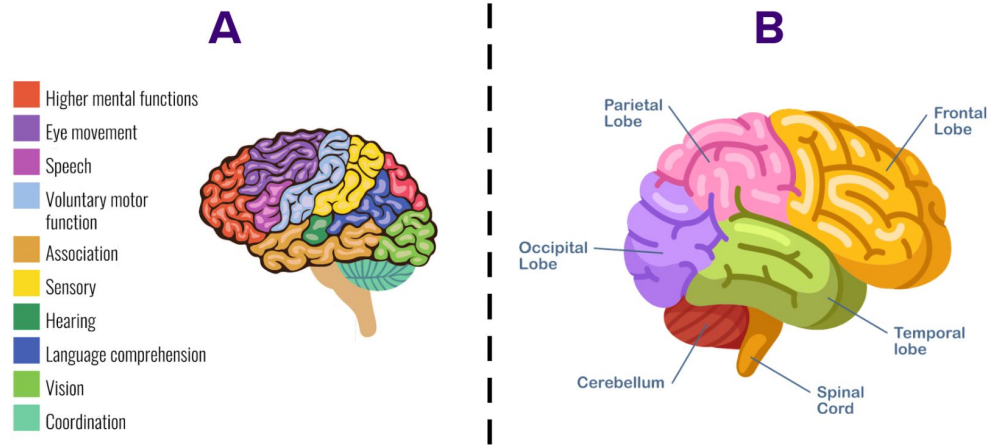
Signaling

People learn better when there are visual cues that draw attention to focus areas and key points



Spatial Contiguity

people learn better when related words and pictures are placed close by on the page or screen.



Modality

People learn better from graphics and narrations than from animation and onscreen text.

Arrays

0	1	2	3	4
3	2	8	16	12

A hand-drawn diagram of an array. Above the array cells are indices 0, 1, 2, 3, and 4. The cells contain the values 3, 2, 8, 16, and 12 respectively. A hand holding a black pen is pointing at the first cell (index 0).

Coherence Principle

People learn better when unnecessary words, pictures and sounds are removed.

BAD



1. Intro

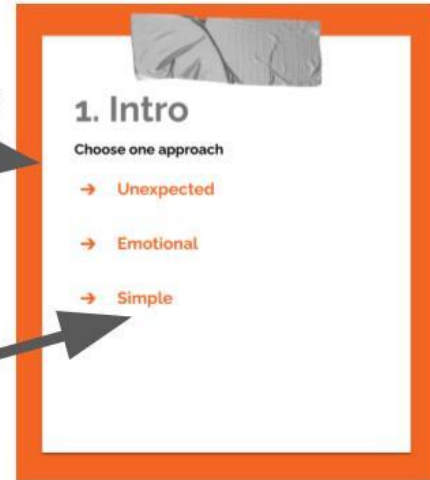
Choose one approach to grab the audience's attention right from the start: unexpected, emotional, or simple.

- Unexpected
Highlight what's new, unusual, or surprising.
- Emotional
Give people a reason to care.
- Simple
Provide a simple unifying message for what is to come

Remove unnecessary
images →

Do you really need
that sub text? →

GOOD



1. Intro

Choose one approach

- Unexpected
- Emotional
- Simple

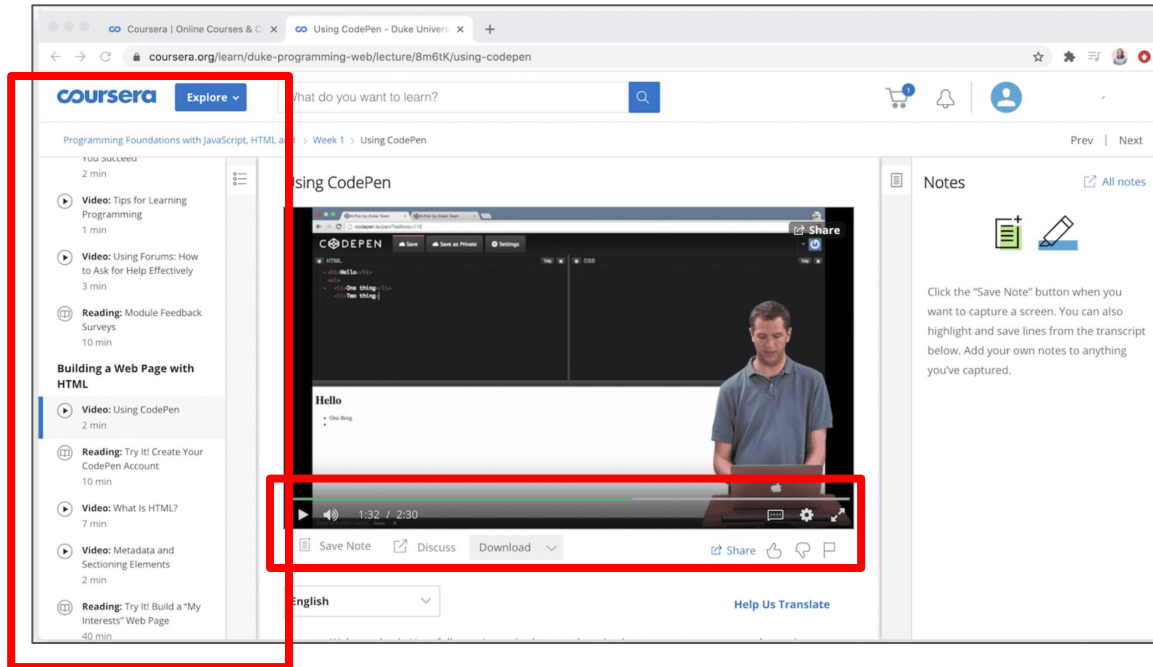
Coherence Principle

People learn better when unnecessary words, pictures and sounds are removed.



Segmenting

People learn better when a multimedia lesson is presented in learner-controlled segments rather than as a continuous unit.



Personalization

People learn better from multimedia lessons when words are in conversational style rather than formal style

How is Phase 1 achieved?

Phase 1 is achieved by establishing a 30% decrease in breakdowns.



This

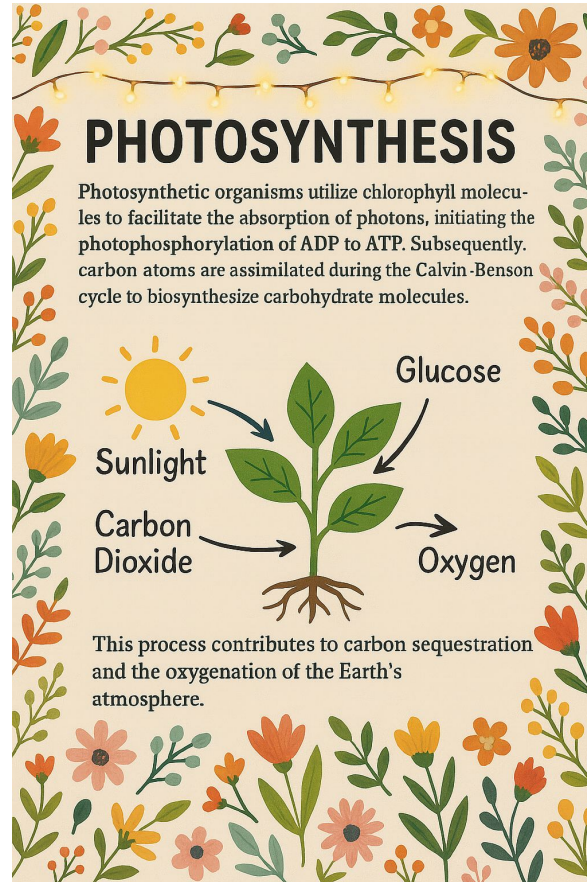
How is Phase 1 achieved?

Phase 1 is achieved by implementing the appropriate maintenance tools and structural conformities which meet our organizations core competencies of establishing a 30% decrease in breakdowns.

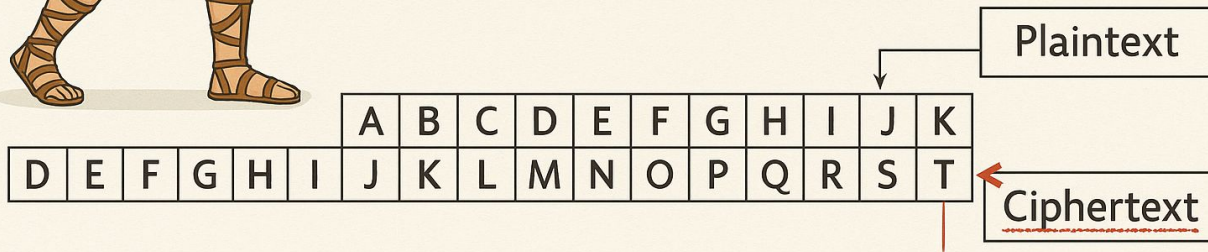
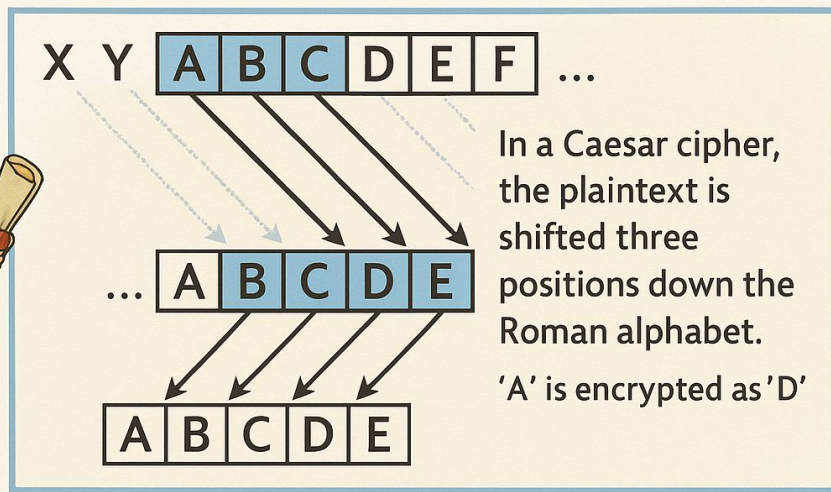


Not This

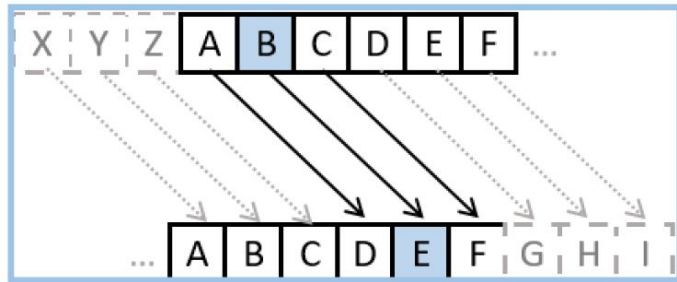
Looks Good, Teaches Poorly? Find the Flaws! - 1



Looks Good, Teaches Poorly? Find the Flaws! - 2



Looks Good, Teaches Poorly? Find the Flaws! - 3



SHIFT +3

This Caesar cipher has a shift of 3 characters.

The letter 'A' becomes a 'D'. The letter 'B' becomes 'E'.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C

Plaintext

Ciphertext

From Principles to Practice - towards effective integration of ICT

We started by asking -

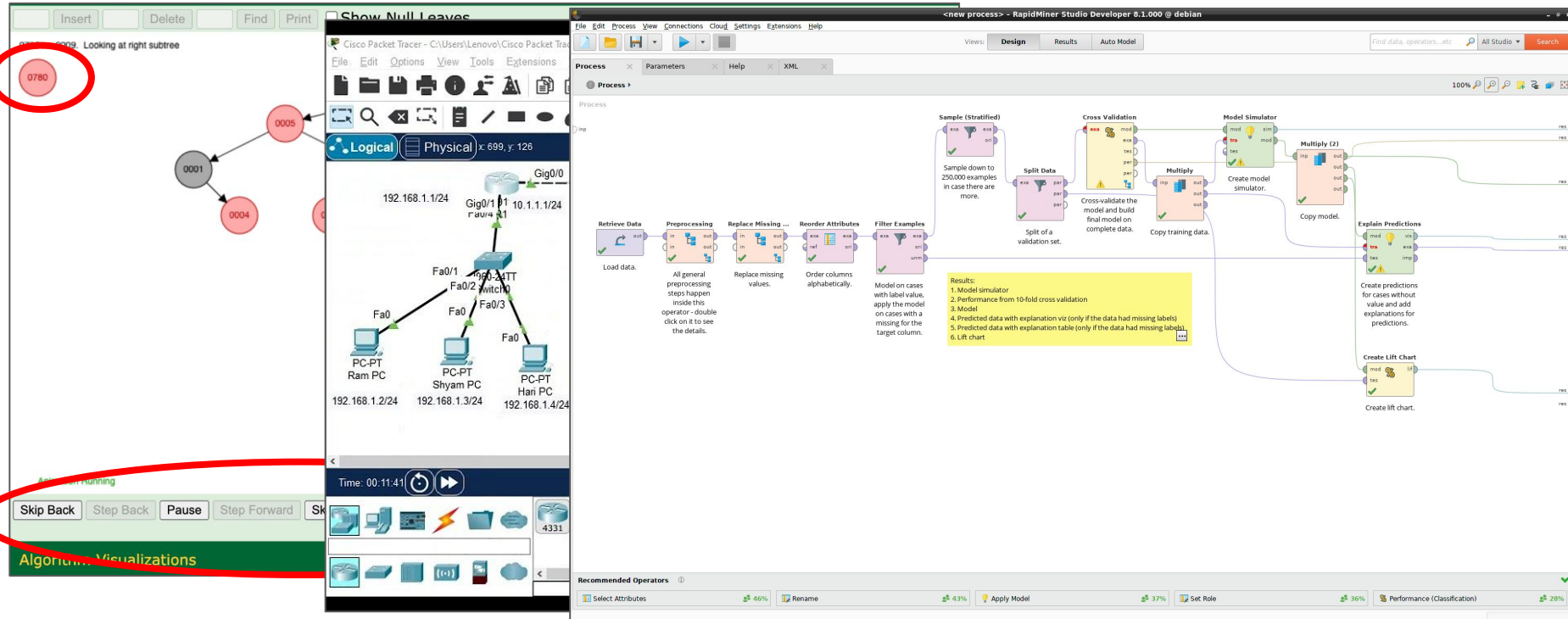
- ***how human brain works?*** - cognitive load theory
- ***can we use this in our favour?*** - leveraging dual channel of the working memory
- ***what are the implications?*** - multimedia principles

Implications to practice - Design integration strategies

- preparing students, instructional methods, grouping, ...

Example: Effective integration of visualization

Visualization (for our purpose here) = animation, simulation, video, etc.



How do most instructors use visualization in class?

- Teacher will play/ show/ demonstrate visualization (using ppt, projector etc)
- ...

How do most instructors use visualization in class?

- Teacher will play/ show/ demonstrate visualization (using ppt, projector etc)
- Teacher will give narrative explanation
- Students will watch and ask for clarification

Do you think demo and explanation of visualization is effective?

- 1) Yes
- 2) No

How do most instructors use visualization in class?

- Teacher will play/ show/ demonstrate visualization (using ppt, projector etc)
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Do you think demo and explanation of visualization is effective?

1) Yes

2) No

What do you mean by “effective”? TPS activity

THINK: Write one definition of what you mean by effectiveness.

What do you mean by “effective”? TPS activity

PAIR: Discuss your definition of effectiveness with your neighbour. Do you agree with your neighbour's definition?

Together, agree upon two possible definitions.

What do you mean by “effective”? TPS activity

SHARE: Share your definitions of effectiveness with your fellow participants.

- Effectiveness is...
 - How they are going to actively participate -----> engagement
 - Doing right things -----> skills level?
 - Apply (any) technique and measuring LO -----> measuring LO
 - How we are reachable to all
 - Achieving LO
 - Grasping attention on the content
 - 90% of students must
 - Satisfaction and feedback

Purpose and effectiveness - different perspectives

- Teacher can cover syllabus faster
- Teacher can use more technology

Efficiency,
Teacher centric

- Make invisible elements visible
- Trace motion / trajectory

Content centric

- Students will be able to:
- Explain the reason underlying phenomenon
 - Draw multiple representations of a process

Learner centric

Why do teachers use visualization?

- Make invisible visible– atoms, cells ...
- Ability to visualize – 3D, internals ...
- Improved conceptual understanding

Learning goals

- Higher motivation, engagement

*Imp goal but not always
same as learning*

- Easier / less boring than blackboard

*Sometimes we
have this goal 😊*

Use of visualizations

Visualizations lead to improved learning only if used 'well' :

- Mere demonstration / playing / viewing **not enough**
- If students can directly interact with viz (for ex in lab /HW), teacher should provide **inquiry-based activities**
- If teacher has to play visualization (for ex in lecture), use **active-learning strategies**

Example of active learning strategy with visualization

A helium balloon is attached to a string tied to the bottom of a cart on wheels. The sides of the cart are encased in clear plastic. A person will abruptly push the cart to the left.

VOTE - Will the balloon move?

- 1) Yes, backward
- 2) Yes, forward
- 3) No



Example of active learning strategy with visualization

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When the cart moves left, the air gets pushed to the right, and the helium balloon moves left to escape the higher air pressure — so it goes forward with the cart.

Example of active learning strategy with visualization

VOTE - Will the balloon move?

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PREDICT



OBSERVE

EXPLAIN

When the cart moves left, the air gets pushed to the right, and the helium balloon moves left to escape the higher air pressure — so it goes forward with the cart.

How the Predict-Observe-Explain (POE) strategy work?

- Asking students to **predict** first helps them observe more carefully.
- **Writing predictions** motivates students to find out what really happens.
- When students **explain their predictions**, teachers gain insights into their thinking and uncover **misconceptions**.
- Students **explain and evaluate** their predictions and compare with others' ideas — helping them **construct new understanding**.

Techniques to manage attention span

Use the 10 minute rule

Reset attention every ~10 minutes using:

- A question
- A visual
- Peer chat
- Demo or video
- Mini quiz

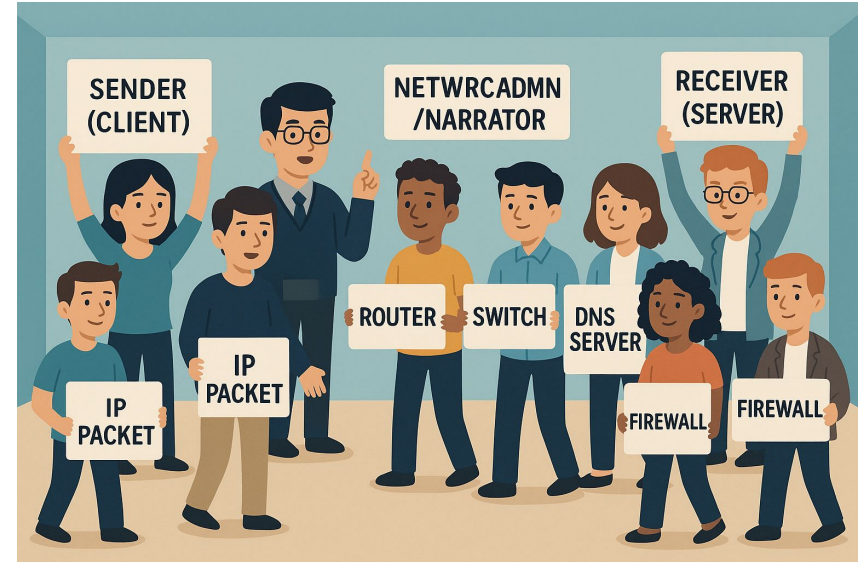
Techniques to manage attention span

Role play the concept

E.g., “*Be the Packet!*” — Tracing an IP Packet Across the Internet

Roles Assigned:

- Sender (Client)
- Receiver (Server)
- IP Packet (1 or 2 students walk with the data)
- Router(s)
- Switch(es)
- DNS Server (Optional)
- Firewall (Optional)
- Network Admin / Narrator (you or a student guide)



Techniques to manage attention span

Sticky Note Wall / Muddy points

- One-Minute Task: Write
 - 💡 One thing they learned
 - ? One question they still have
- Stick on a wall or board.
- Can be revisited at the end of class or next day.



Lunch