Writing Learning Outcomes

Prof Phil Newton

Swansea University, Wales

Hello!

Get a pen and paper!

Who am I and why am I here

- Prof Phil Newton
  - Swansea University Medical School
  - Neuroscientist
  - MSc Medical Education
  - Evidence Based Education
  - Academic Integrity
  - Nerd

Menu for Today

- What is a Learning Outcome
- Development of Expertise - facts
- Constructive Alignment
- Specific and Measurable verbs
- Lunch
- Development of expertise - skills
- What make a good assessment
- Writing outcomes and aligning to assessments
- Summary

Menu for Today

- What is a Learning Outcome
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What is a Learning Outcome?

A statement of what learners will be able to do once they have completed their learning

What is a Learning Outcome?

do

Benjamin Bloom (1913-1999)

To write measurable Learning Outcomes 🙂

To know what Learning Outcomes are ☹

To **write** measurable Learning Outcomes

To **know** what Learning Outcomes are

Explain
List
Define
Differentiate
Appraise
Evaluate
Diagnose

SMARTIE

SMARTIE

Specific   what, by whom?

SMARTIE

Measureable   how much

SMARTIE

Specific   what, by whom?

Measureable   how much

Achievable   resources and timeframe

SMARTIE

Specific   what, by whom?

Measureable   how much

Achievable   resources and timeframe

Relevant   aligned with discipline, assessment etc

SMAR**T**IE

Specific   what, by whom?

Measureable   how much

Achievable   resources and timeframe

Relevant   aligned with discipline, assessment etc

Time-bound   when?

Inclusive   universal design

Evident   visible to learners

SMARTIE

Specific   what, by whom?

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**R**elevant   aligned with discipline, assessment etc

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SMARTIE

Specific   what, by whom?

Measureable   how much

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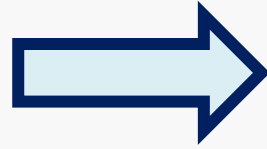
Time-bound   when?

Inclusive   universal design

Evident   visible to learners

Novice $\Rightarrow$ $\Rightarrow$ $\Rightarrow$ **Expert**

Newton *et al* 2021
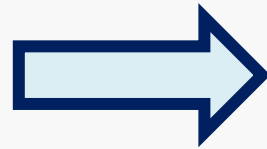
Get a pen and paper!

Lightning Learning Activity 1

- Next slide will display for 8 seconds – list of words
- Then blank slide for 5 seconds
- *After* blank – write down those you remember from first

Kilkenny
Cork
Drogheda
Dublin
Dundalk
Galway
Limerick
Navan
Swords
Waterford

Write them down

Lightning Learning Activity 2

- Next slide will display for 8 seconds – list of words
- Then blank slide for 5 seconds
- *After* blank – write down those you remember from first

San José

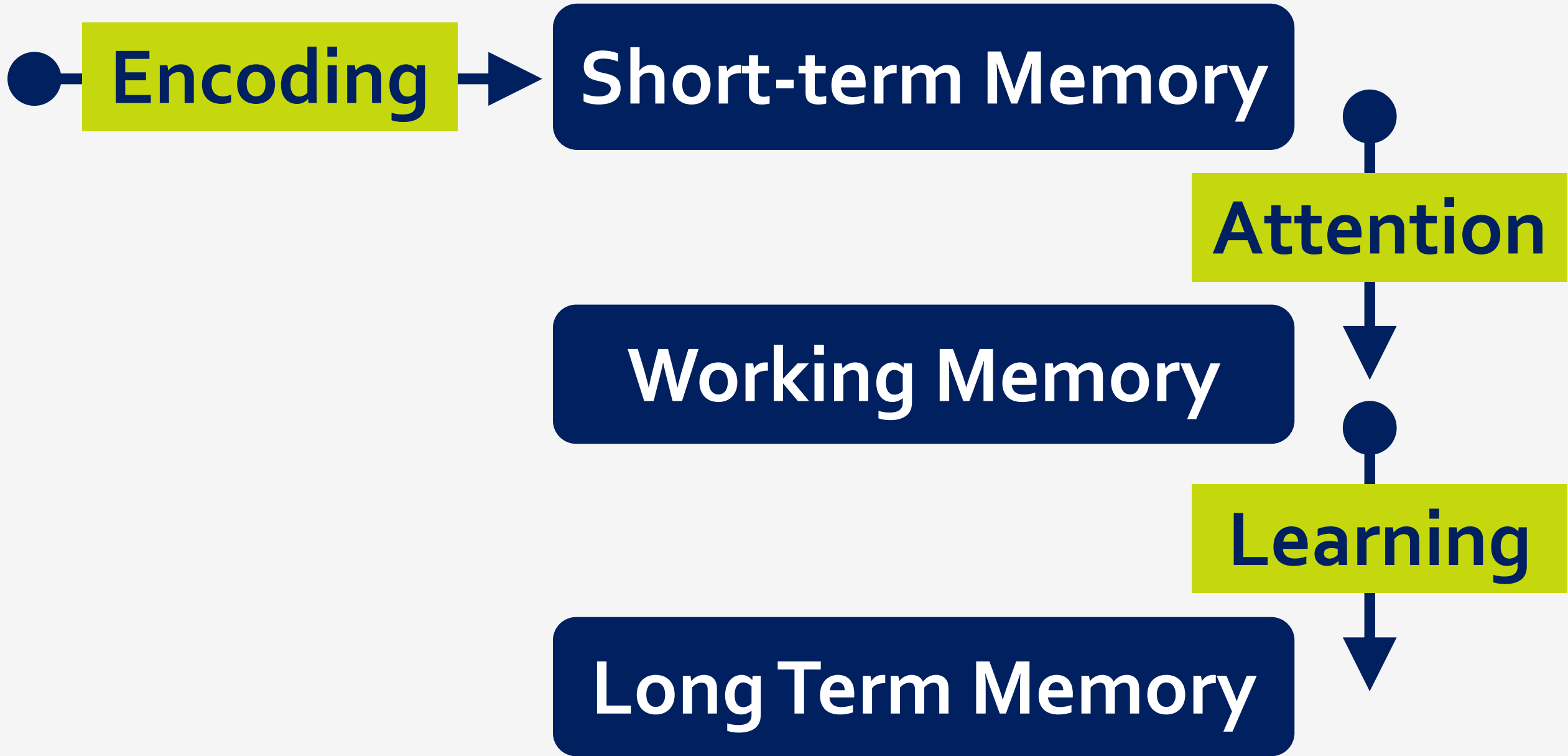Puerto Limón

Alajuela

Heredia

Cinco Esquinas

Desamparados

Liberia

Puntarenas

San Vicente

Barranca

Write them down

Encoding → **Short-term Memory**

Attention

Working Memory

Learning

Long Term Memory

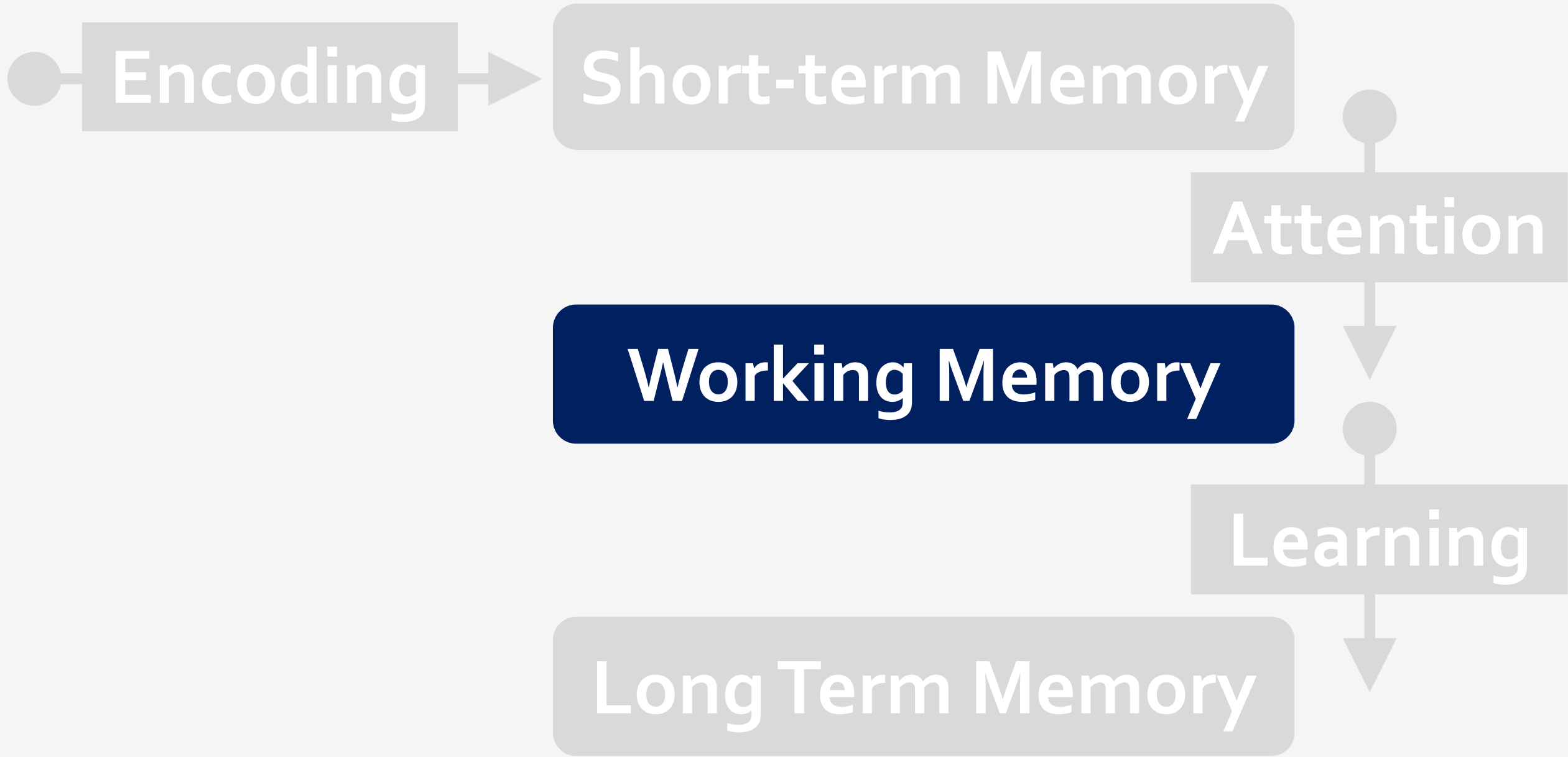San José

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Encoding → Short-term Memory
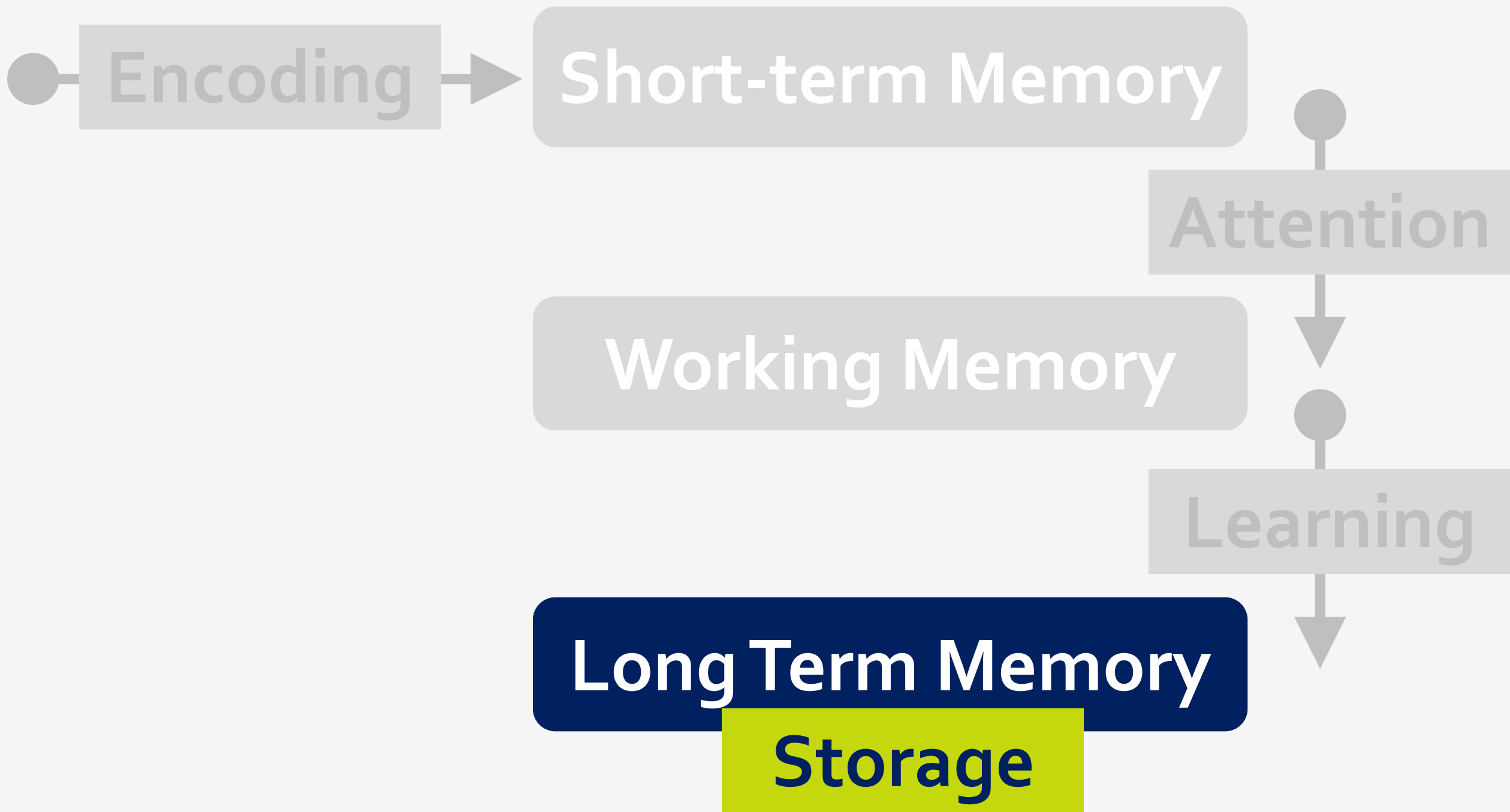
Attention

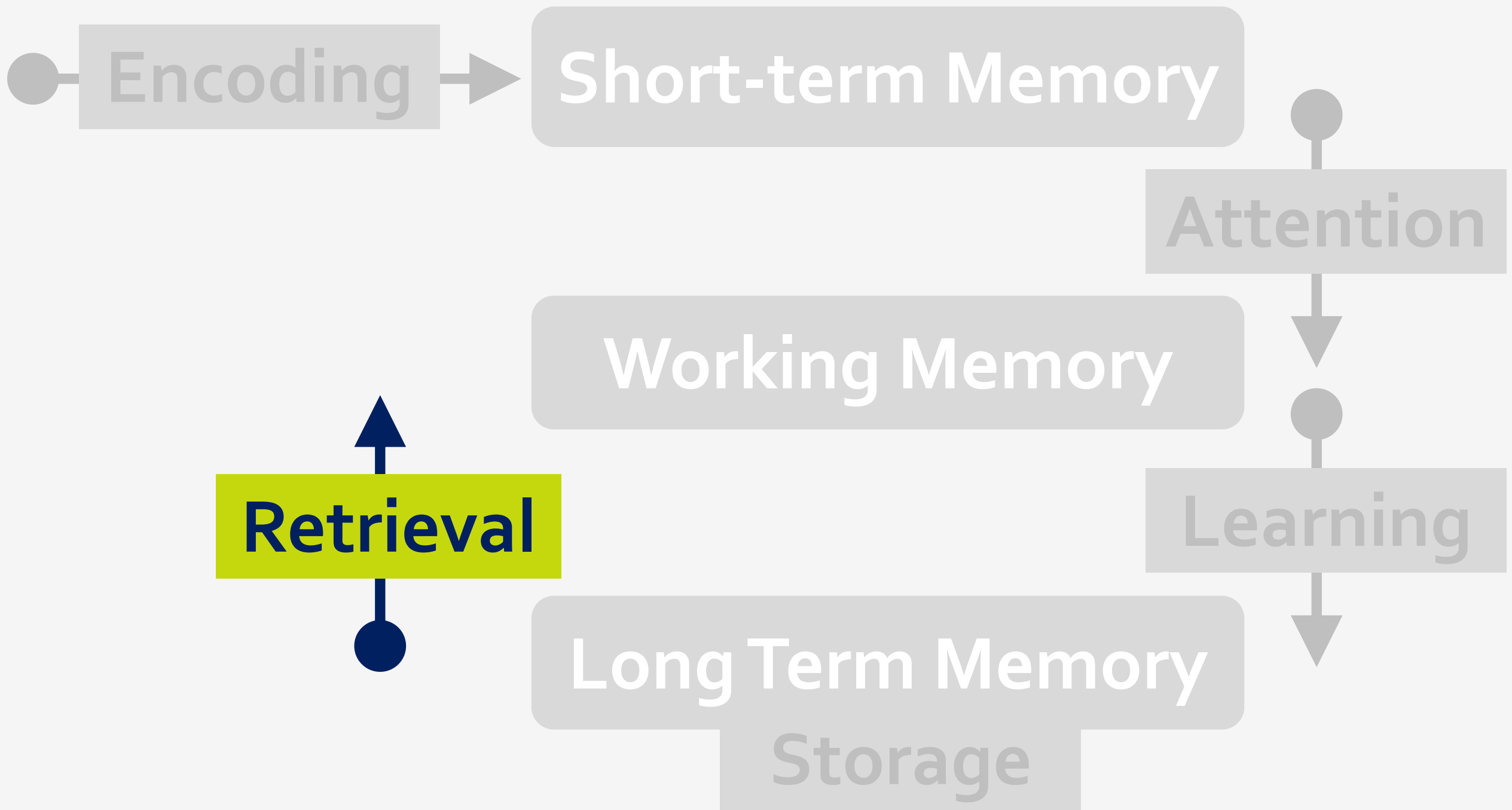**Working Memory**

Learning

Long Term Memory

Encoding → **Short-term Memory**

Attention

Working Memory

Learning

Long Term Memory

Storage

Any others?

What did you do?

Kilkenny
Cork
Drogheda
Dublin
Dundalk
Galway
Limerick
Navan
Swords
Waterford

Encoding → **Short-term Memory**

Attention

Working Memory

Learning

Retrieval

Long Term Memory

Storage

How do we learn

- Working memory is a bottleneck
  - 4-7 'chunks' of information
- Learning; matching new information (working memory) to existing knowledge (*retrieved* from long-term memory)
  - 'Retrieval Practice' really helps learning
- Learning is stored as 'schema'
  - Related learning is stored together
  - Retrieved as one 'chunk'
- More learning = expertise = bigger chunks retrieved

Foundational Knowledge

Substantia nigra

Amygdala

Hippocampus

Temporal Cortex

Broca's area

Medulla

Parietal Cortex

Pons

Basal ganglia

Occipital Cortex

Cerebellum

Substantia gelatinosa

Corpus callosum

Lateral sulcus

Globus pallidus

Dorsal horn

Lissauers tract

Spinothalamic tract

Dorsal column

Ventral root

Mamillary bodies

Wernickes area

Frontal Cortex

Prefrontal Cortex

Subthalamic nucleus

Midbrain

Cingulate gyrus

Thalamus

Hypothalamus

Optic chiasm

Foundational Knowledge

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Constructive Alignment (Biggs 1996)

Intended Outcome

Teaching and Learning activities

Assessment

Biggs, J. (1996). Enhancing teaching through constructive alignment. Higher education, 32(3), 347-364.

Alignment

Understand local anaesthetics

Alignment

Identify effective doses of local anaesthetics

Alignment

Identify effective doses of local anaesthetics

Lectures, independent study

Multiple Choice Exam

Alignment

Administer effective doses of local anaesthetics

Small group clinical skills

Clinical Exam, Workplace Assessment

SMARTIE

Specific	what, by whom?
Measureable	how much
Achievable	resources and timeframe
Relevant	aligned with discipline, assessment etc
Time-bound	when?
Inclusive	universal design
Evident	visible to learners

Identify some specific verbs
(Identify some non-specific verbs)
(How would you know)

To <u>write</u> measurable Learning Outcomes ☺

To <u>know</u> what Learning Outcomes are ☹

Summary of Pt 1

- Learning outcome indicates what learners can **_do_**
- Action verbs define the outcome
- Expertise level defines the verb
- Prior learning defines expertise

Constructive Alignment

Intended Outcome

Teaching + Learning activities

Assessment

Biggs, J. (1996)

A good assessment

Is a measure of what someone can <u>do</u>

Invigilated	Uninvigilated
Closed Book	Open Book
In-person	Online
Real-time	Asynchronous
High Stakes	Low Stakes
Summative	Formative
Objective	Subjective
Low Level	High Level
Unseen	Seen

Validity

Reliability

Authenticity

Integrity

Experience

Inclusivity

Equitability

Practicality

What does the student *do*

- Answer MCQs
- Write free text
- Give a presentation
- Perform a practical skill
- Projects
- Oral viva
- 'Work'

- Exams
- Essays, dissertations
- Talk, poster
- Lab skills, data analysis etc
- Capstone, research report
- Thesis defence
- Mentor Rating

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Validity
is the right thing being measured

Reliability
Is it being measured accurately

Components of Validity

- **Most important requirement for assessment design**
- Content validity
  - Assessment aligned with curriculum content?
- Criterion validity
  - Assessment aligned with learning objective?
- Construct Validity
 - Assessment measures what it is supposed to?

Reliability of assessment design

- Consistency - how likely is it that the same student, taking the same assessment on two different occasions, will get the same mark each time
- Sources of variance
  - Student
    - Hungry? Tired? Stressed? Distracted?
  - Assessment
    - Inter-marker reliability
    - Intra-marker reliability
    - Content/subject reliability
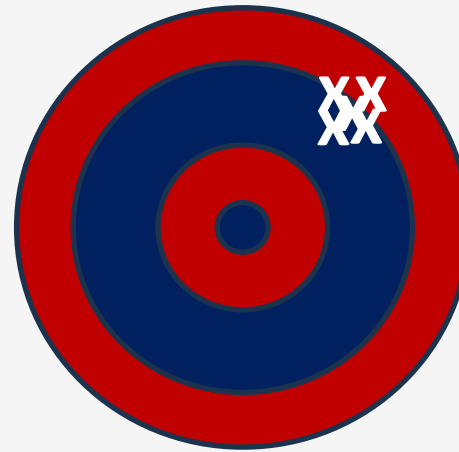- Cannot really have validity without reliability
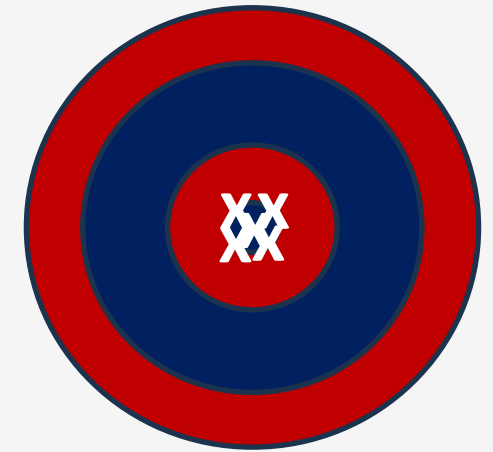
Validity vs reliability
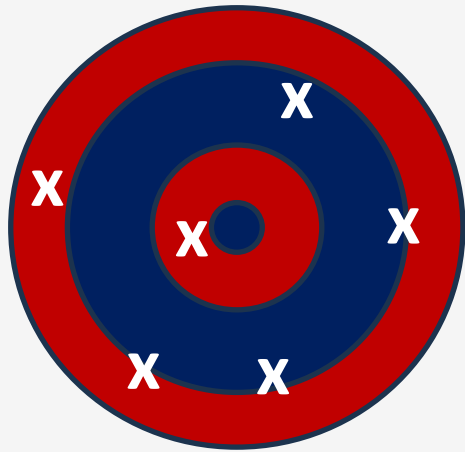
Neither valid or reliable
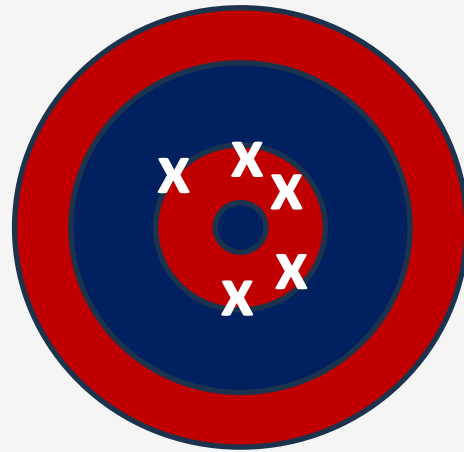
Valid but unreliable?

Not valid but reliable

Valid and reliable

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Practicality

Reflects the discipline/workplace
Often complex and messy

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Do students enjoy it?
(Do students dislike it less?)

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Practicality

Practicality of assessment design

- Time to write items
- Marking
  - Number of markers
  - Time to mark individual items
- Administration
- Physical space
- Assessment security
- Technology costs
- etc

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Experience

**Inclusivity
Equitability**

Practicality

Inclusivity and Equitability of assessment design

- One version (Universal Design)
- Fair to all?
  – Bias based on any characteristic (protected or otherwise)
  – Accessible
  – Cost (to learner)
- Balance with professional requirements?
- Anonymous marking?
  – Single or double blind

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Validity

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Experience

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Equitability

Practicality

Summative – carries course credit
Formative – does not

Invigilated	Uninvigilated	Validity
Closed Book	Open Book	Reliability
In-person	Online	Authenticity
Real-time	Asynchronous	Integrity
High Stakes	Low Stakes	Experience
Summative	Formative	Inclusivity
Objective	Subjective	Equitability
Low Level	**High Level**	
Unseen	Seen	Practicality

Just 'facts'?

Recall shmecall

Working vs Long Term Memory

- Long-term memory
  - Huge capacity
- Working Memory
  - Very (very) very limited capacity
  - **4-7 'chunks'**
  - Is a bottleneck for learning

Call out the answer as soon as you know

Call out the answer as soon as you know

9 x 9 = ?

Call out the answer as soon as you know

17 X 17= ?

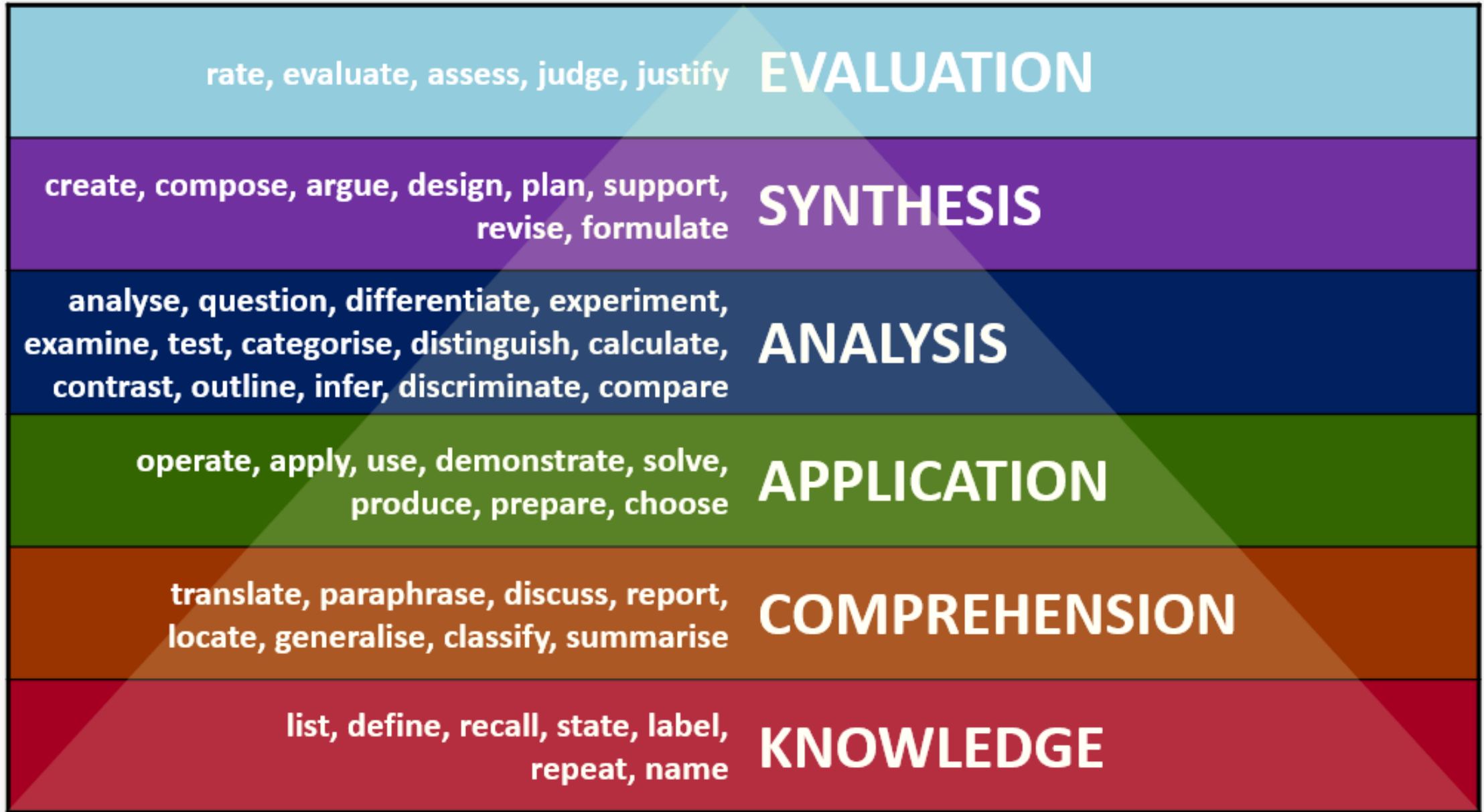Call out the answer as soon as you know

621 x 247= ?

Cognitive Level

Memorising Facts or Solving Problems?

rate, evaluate, assess, judge, justify **EVALUATION**

create, compose, argue, design, plan, support, revise, formulate **SYNTHESIS**

analyse, question, differentiate, experiment, examine, test, categorise, distinguish, calculate, contrast, outline, infer, discriminate, compare **ANALYSIS**

operate, apply, use, demonstrate, solve, produce, prepare, choose **APPLICATION**

translate, paraphrase, discuss, report, locate, generalise, classify, summarise **COMPREHENSION**

list, define, recall, state, label, repeat, name **KNOWLEDGE**

Newton *et al* 2021

Lower level **Name** a brain region which is damaged in Alzheimer Disease

Higher level **Evaluate** a dementia scenario and the brain region(s) damaged

Cognitive Level

- Level I   **Knowledge**
  - recall of information

- Level II   **Comprehension and Application**
  - understanding and being able to interpret data

- Level III   **Problem-solving**
  - use of knowledge and understanding in new circumstances.
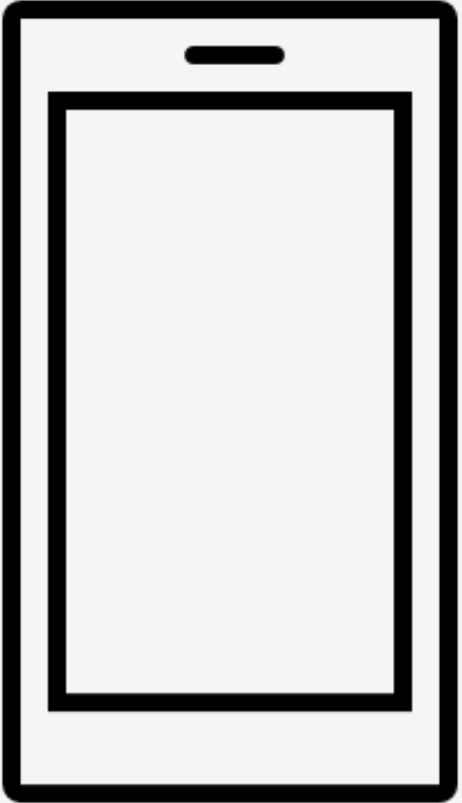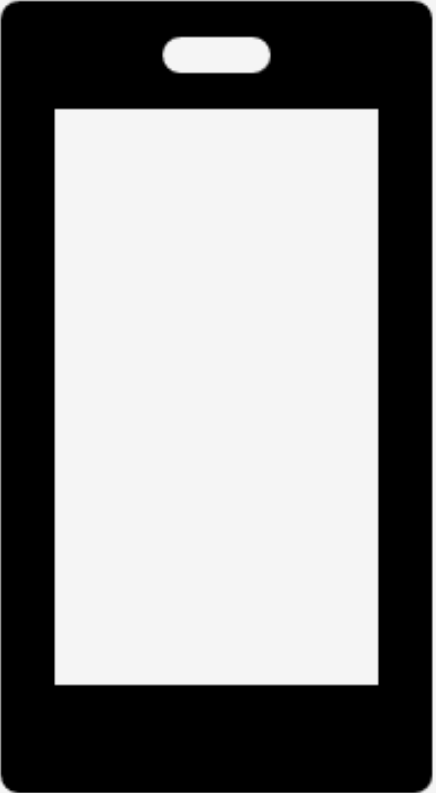
National Board Medical Examiners (USA)

- **Lower Order**   Recall of a Fact

- **Higher Order**   Application of Knowledge

Facts are important

Cannot critically appraise something without basic knowledge

Foundational knowledge is essential

Higher order skills depend on basic knowledge

Willingham 2006

Lower Order or Higher Order?

Depends whether you can answer it!

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Academic Integrity
(doing the right thing)

Cheating
(doing the wrong thing)

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Assessing Assessments

- Answer MCQs
- Write free text
- Give a presentation
- Perform a practical skill
- Projects
- Oral viva
- 'Work'

- Exams
- Essays, dissertations
- Talk, poster
- Lab skills, data analysis etc
- Capstone, research report
- Thesis defence
- Mentor Rating

Multiple Choice Exams

- Knowledge test
- Broad coverage of curriculum
  - Bank of questions
- Normally
  - 'single best answer' (from ~5)
  - Closed book
    - Live, in-person, invigilated
  - Time limited
- Automatically marked

Essays (coursework)

- Asynchronous
- Narrow, but in-depth
  - Critical of literature
- Extended timeframe
- Referenced
- 1-2 markers
  - moderation

Presentations

- Short, live presentation prepared by the student
  - Also posters, pitches, etc
- Questions from peers and instructors
- Can assess content knowledge and presentation skills

Practical Assessment

- Laboratory, data analysis, clinical
- Assess the product or the process?
  - Direct observation?
- Patients/actors/scenarios?
- Record assessment?

Workplace-based Assessment

- Assessed by employer and academic?
- What to assess?
  - Traditional assessment in an employment setting?
  - Reflective account?
  - Attendance/engagement?
- Variability between students?

Which assessment format is the most reliable?

Practical Assessments

Multiple Choice Questions
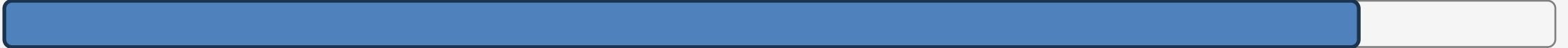
Presentations
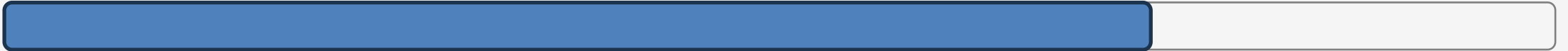
Essays (Coursework)
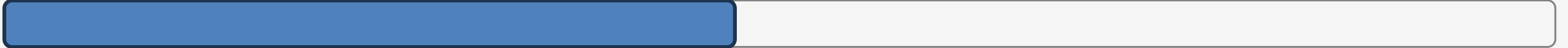
Workplace-Based Assessment

RESULTS SLIDE

Which is the most susceptible to cheating?

Essays (Coursework)

Presentations

Workplace-Based Assessment

Multiple Choice Questions

Practical Assessments

RESULTS SLIDE

Write a Learning Outcome

Make it SMARTIE

Align an Assessment

Valid and.......

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Practicality

Specific, Measurable, Achievable, Relevant, Time-bound, Inclusive, Evident

Summary

- Assessment design requires validity
- All else is pragmatic choices

Image credits

- Benjamin Bloom - https://www.thoughtco.com/benjamin-bloom-critical-thinking-models-4078021
- Young Bundee Aki
    - https://rugbylad.ie/the-incredible-story-of-how-a-legendary-all-black-convinced-bundee-aki-to-play-rugby-again/
- Champion Bundee Aki - https://twitter.com/SportsJOEdotie/status/1637359500423495682
- Young Florence Nightingale
    - https://florencenightingale05121820.weebly.com/backgroud-information.html
- Expert Florence Nightingale
    - https://en.wikipedia.org/wiki/Florence_Nightingale#/media/File:Florence_Nightingale_(H_Hering_NPG_x82368).jpg
- Young Skywalker
    - https://moviemorgue.fandom.com/wiki/Luke_Skywalker
- Jedi Skywalker
    - https://great-characters.fandom.com/wiki/Luke_Skywalker
- Flag Costa Rica
    - https://en.wikipedia.org/wiki/Flag_of_Costa_Rica#/media/File:Flag_of_Costa_Rica.svg
- Flag of Ireland
    - https://en.wikipedia.org/wiki/Flag_of_Ireland#/media/File:Flag_of_Ireland.svg

References

- Biggs, J. (1996). Enhancing teaching through constructive alignment. Higher education, 32(3), 347-364.
- Ellis, C., Van Haeringen, K., Harper, R., Bretag, T., Zucker, I., McBride, S., ... & Saddiqui, S. (2020). Does authentic assessment assure academic integrity? Evidence from contract cheating data. *Higher Education Research & Development*, *39*(3), 454-469.
- Irvine, E. (2021). Developing dark pessimism towards the justificatory role of introspective reports. *Erkenntnis*, *86*(6), 1319-1344.
- Newton, P. M., Da Silva, A., & Peters, L. G. (2020). A pragmatic master list of action verbs for bloom's taxonomy. *Frontiers in Education* (Vol. 5, p. 107)
- Race, P. (2015). The Lecturer's Toolkit: A practical guide to assessment, learning and teaching. *4th Ed.*
- Stringer, J. K., Santen, S. A., Lee, E., Rawls, M., Bailey, J., Richards, A., ... & Biskobing, D. (2021). Examining Bloom's taxonomy in multiple choice questions: students' approach to questions. *Medical Science Educator*, *31*(4), 1311-1317.

Questions?

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 newtonsneurosci