

Writing and Assessing 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
 - Pragmatist

PRAGMATISM



Menu for Today

- What is a Learning Outcome
- Development of expertise - facts
- Constructive Alignment
- Rewrite outcomes using 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
- **Development of expertise - facts**
- Constructive Alignment
- **Rewrite outcomes using measureable verbs**
- **Lunch**
- **Development of expertise - skills**
- What make a good assessment
- **Writing outcomes and aligning to assessments**
- Summary

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



Learn

Know

Understand

Be aware of

Be familiar with

Appreciate

Acknowledge

SMARTIE

Specific

what, by whom?

Measureable

how much

Achievable

resources and timeframe

Relevant

aligned with discipline, assessment etc

Time-bound

when?

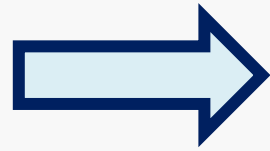
Inclusive

universal design

Evident

visible to learners

Novice



Expert



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

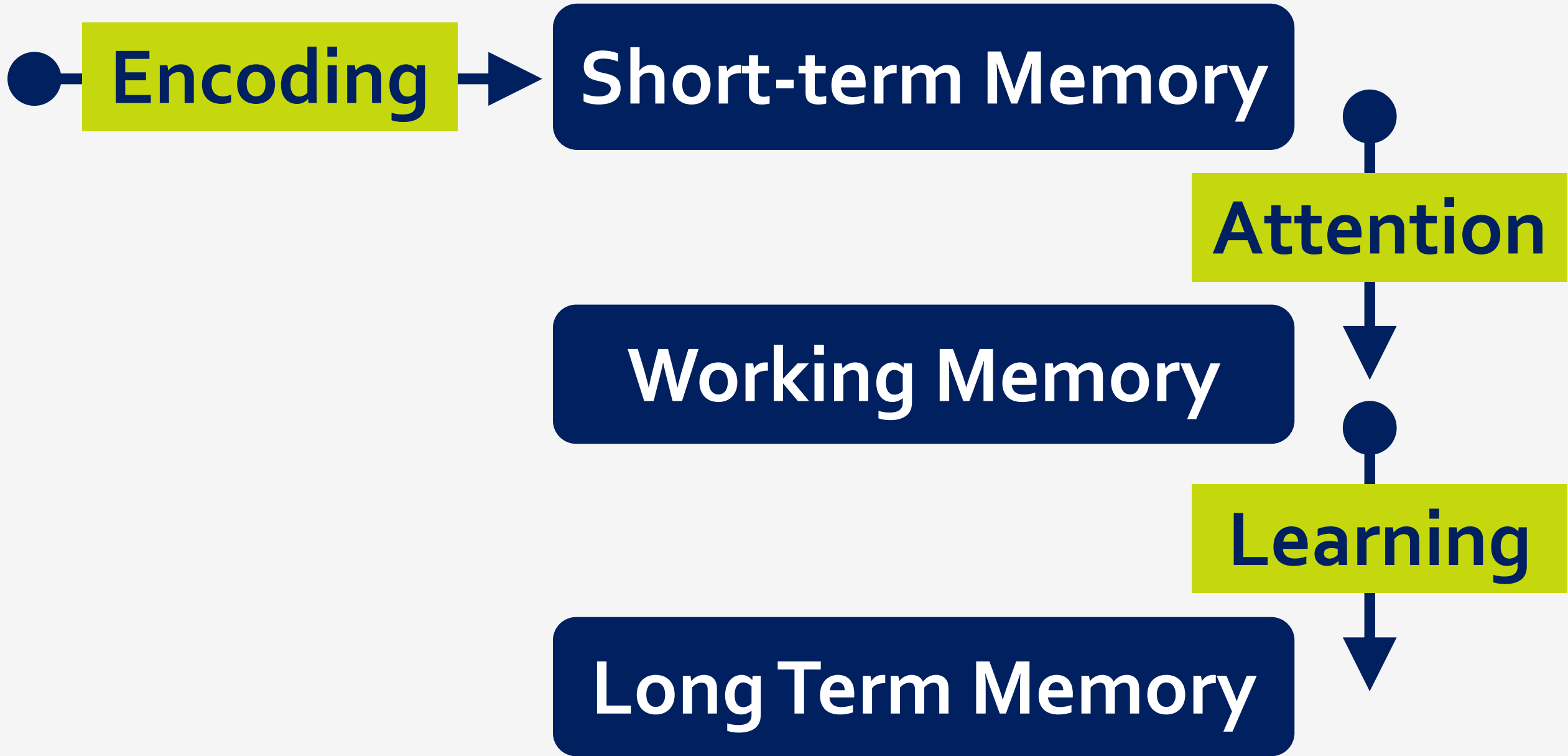
Liberia

Puntarenas

San Vicente

Barranca

Write them down



San José

Puerto Limón

Alajuela

Heredia

Cinco Esquinas

Desamparados

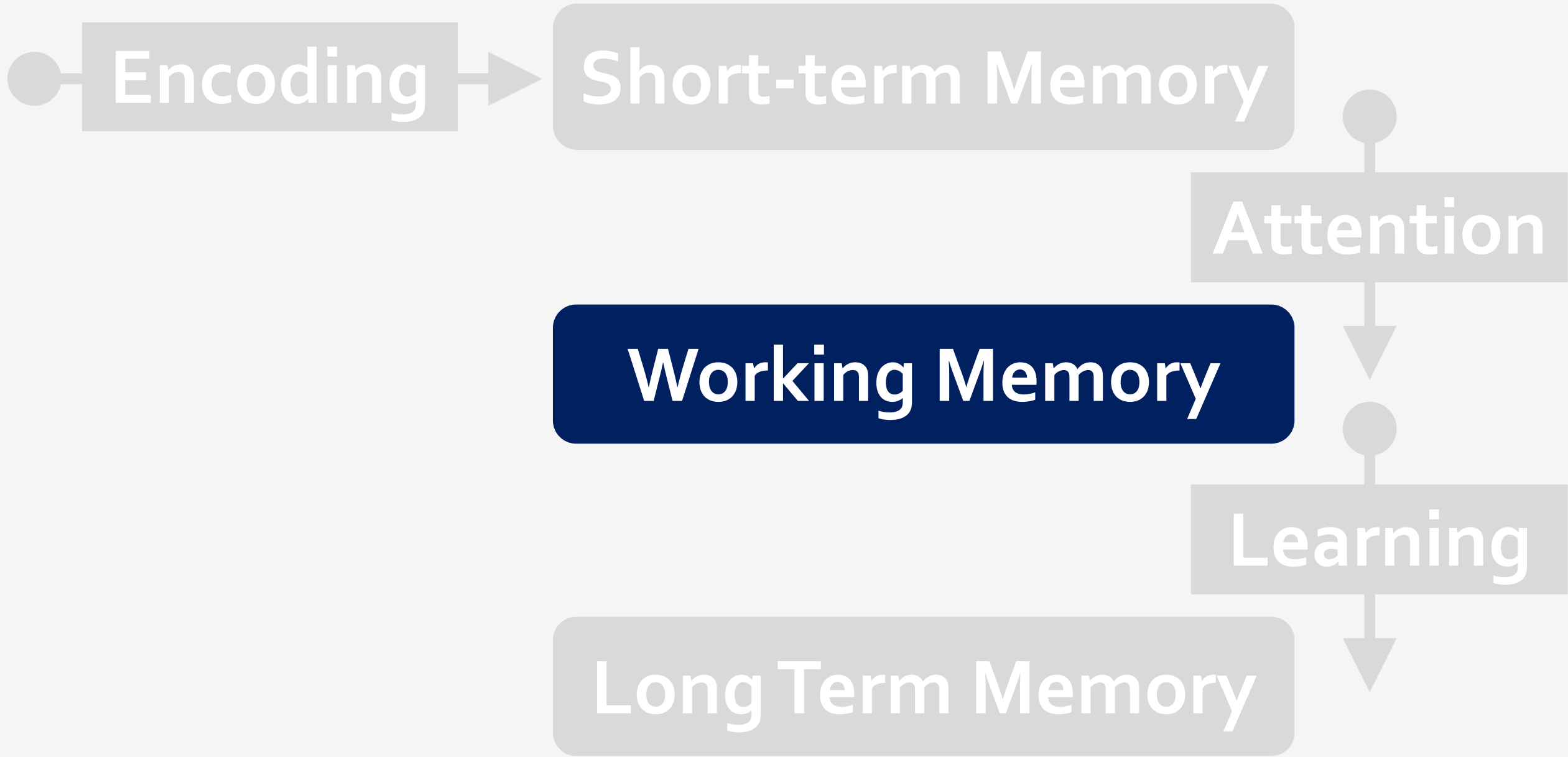
Liberia

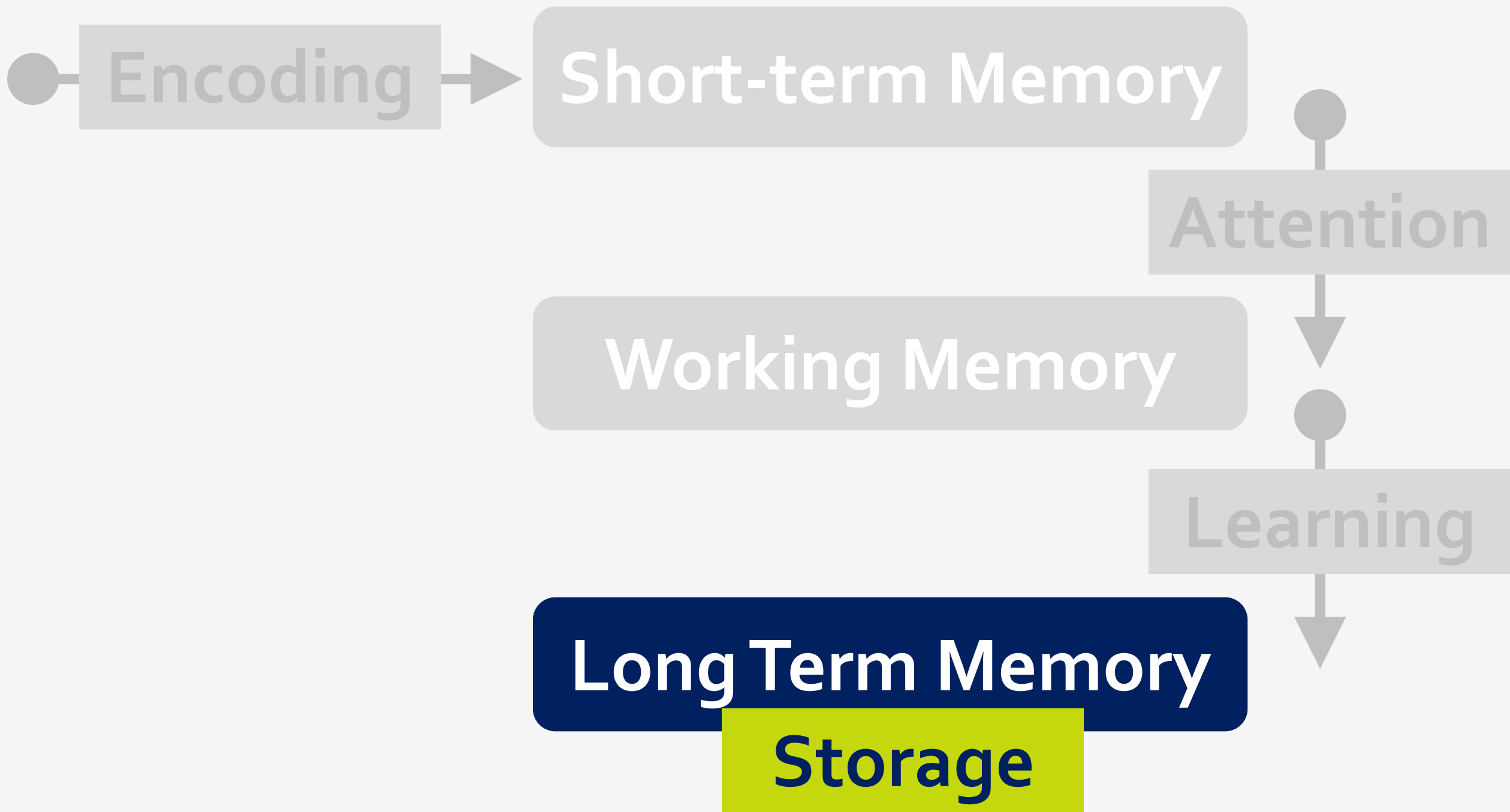
Puntarenas

San Vicente

Barranca





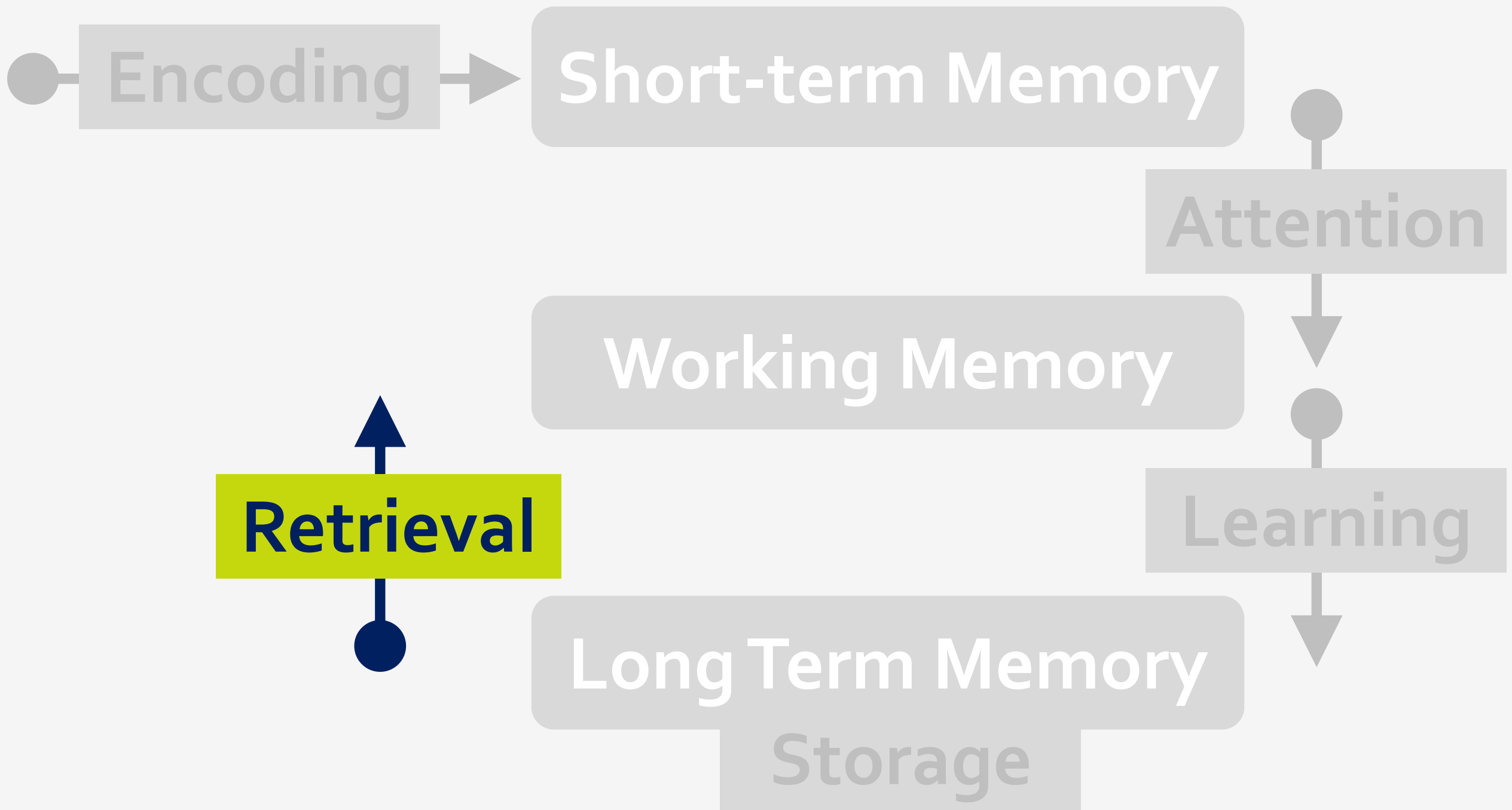


Any others?

What did you do?

- Kilkenny
- Cork
- Drogheda
- Dublin
- Dundalk
- Galway
- Limerick
- Navan
- Swords
- Waterford





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

Retrieval Practice

'The Testing Effect'

Core principles of retrieval practice?

Take practise tests

Write practice tests

Share practice tests

Core principles of retrieval practice?

Take practise quizzes

Write practice quizzes

Share practice quizzes

Has to be a test?

'Bring to mind'

Retrieval Practice works

Retain learning for longer

Learn more

Better than other study methods

Enhances transfer

Retrieval Practice

Reduces test anxiety

Factors influencing success

- 1. Format**
- 2. Frequency**
- 3. Feedback**

How often to do it?

As often as you can?

Format

Free recall is best

MCQs are easiest, but....

Correct-answer feedback

Is really important
(don't learn the *wrong* answer)

Constructive Alignment

Planning and Organising Teaching

Constructive Alignment (Biggs 1996)

Intended Outcome

Teaching and Learning activities

Assessment

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

Rewrite the following Learning Outcomes

One version for novices, one for advanced
Discuss on your table

- **Students will**
 - Be aware of the main sources of research literature in their field
 - Appreciate the main employment challenges in their field
 - Understand current research priorities in the field
 - Work in interdisciplinary teams
 - Know the current digital technology challenges of the field
 - Be familiar with core concepts

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

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

Learning Outcomes

There will be quizzing

Go to vevox.com



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Writing and Assessing Learning Outcomes

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Swansea University, Wales

Constructive Alignment

Intended Outcome

Teaching + Learning activities

Assessment

A good assessment

Is a measure of what someone can do

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
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Validity

is the right thing being measured

Reliability

Is it being measured accurately

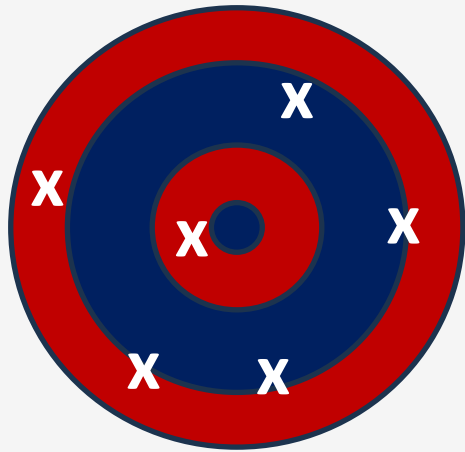
Components of Validity

- **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?

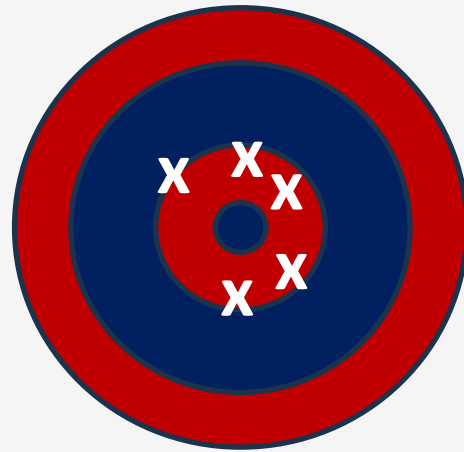
Reliability of assessment design

- 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

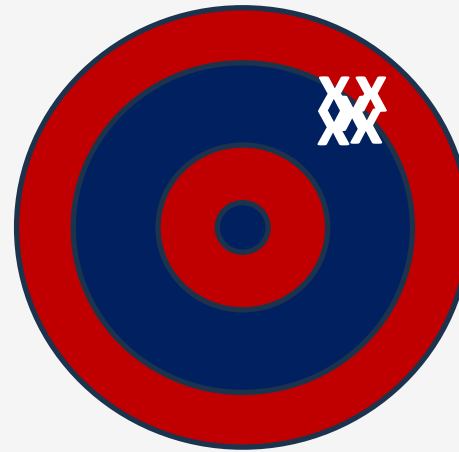
Validity vs reliability



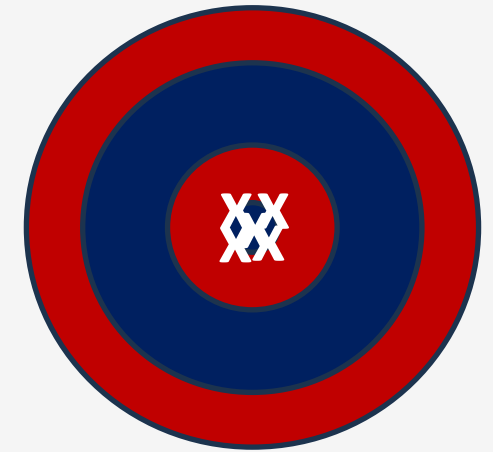
Neither valid
or reliable



Valid but
unreliable?



Not valid but
reliable



Valid and
reliable

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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 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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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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Summative – carries course credit
Formative – does not

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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**

$$9 \times 9 = ?$$

**Call out the answer as
soon as you know**

$$**17 \times 17 = ?**$$

**Call out the answer as
soon as you know**

$$621 \times 247 = ?$$

Working memory limitations

- Apply to any sort of learning
- Complex cognitive processes can be 'automated'
 - Represent one 'chunk' in working memory
- (Cognitive Load Theory is an evidence-based approach which prioritises this when designing learning)

Cognitive Overload

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

Cognitive Overload

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Kilkenny

Cork

Drogheda

Dublin

Dundalk

Galway

Limerick

Navan

Swords

Waterford

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San José

Puerto Limón

Alajuela

Heredia

Cinco Esquinas

Desamparados

Liberia

Puntarenas

San Vicente

Barranca

Cognitive Level

Memorising Facts or Solving Problems?



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

Higher level Evaluate a patient scenario and the brain region(s) involved

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

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

Cognitive Level

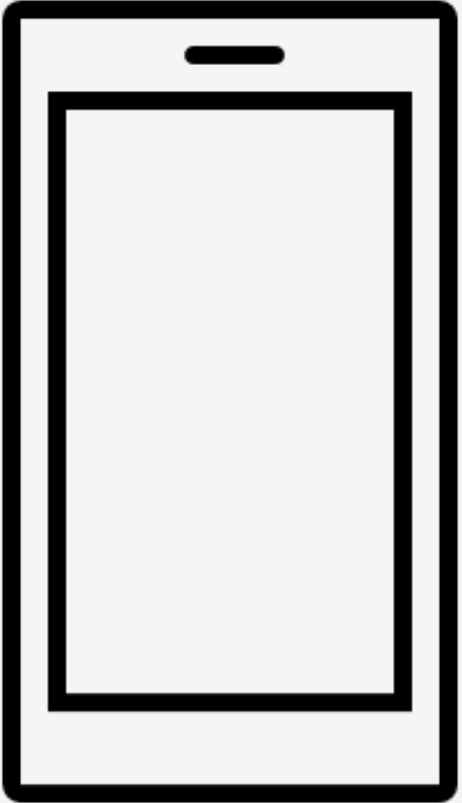
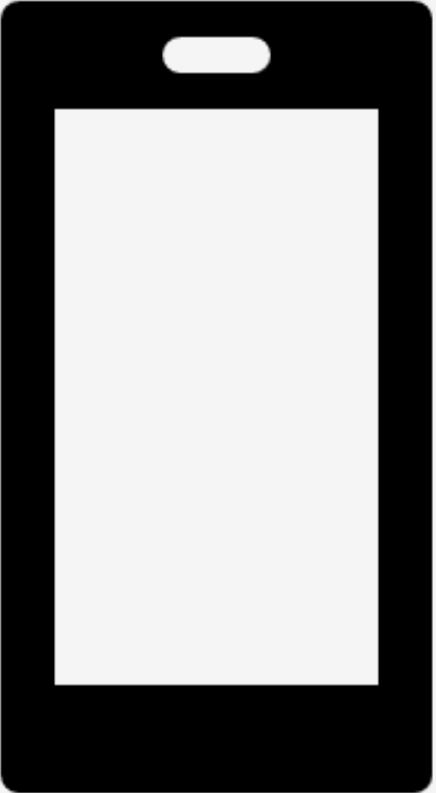
- **Level I Knowledge**
 - recall of information
- **Level II Comprehension and Application**
 - understanding and being able to interpret data
- **Level III Problem-solving**
 - use of knowledge and understanding in new circumstances.

National Board Medical Examiners (USA)

- **Lower Order** Recall of a Fact
- **Higher Order** Application of Knowledge

Facts are important

**Cannot achieve higher order learning
without basic knowledge**



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?

PRAGMATISM



Advantages and Disadvantages

- MCQ-based exams
- Essays (asynchronous coursework)
- Practical skills
- Presentations
- Workplace-based assessments
- (All else being equal)

Picking a reliable assessment format

- **Which format is the most reliable**
- (Assume everything else is equal, as far as possible)
- How would you *know* that an assessment is reliable
- How would you improve reliability



Which is the most reliable?

Multiple Choice Question - Exams

Essays (Asynchronous Coursework)

Presentations

Practical Assessments

Workplace-Based Assessment

**Which are going to give similar marks
each time?**



Which is the most reliable?

Multiple Choice Question - Exams



Practical Assessments



Presentations



Essays (Asynchronous Coursework)



Workplace-Based Assessment



Reliability

- Objectivity improves reliability
- Well constructed, unambiguous assessment items
- Clear rubrics
- Multiple markers (?)
- Trained markers
- Longer assessments
- Broad curriculum coverage

Picking a secure assessment format

- **Which format is the most susceptible to cheating?**
- (Assume everything else is equal, as far as possible)
- What types of cheating would you look for
- How would you know
- How would you improve assessment security



Which is the most susceptible to cheating?

Multiple Choice Question Exams

Essays (Asynchronous Coursework)

Presentations

Practical Assessments

Workplace-Based Assessment

Assume that all are 'in-person'



Which is the most susceptible to cheating?

Essays (Asynchronous Coursework)



Presentations



Multiple Choice Question Exams



Workplace-Based Assessment



Practical Assessments



Academic misconduct is more likely when...

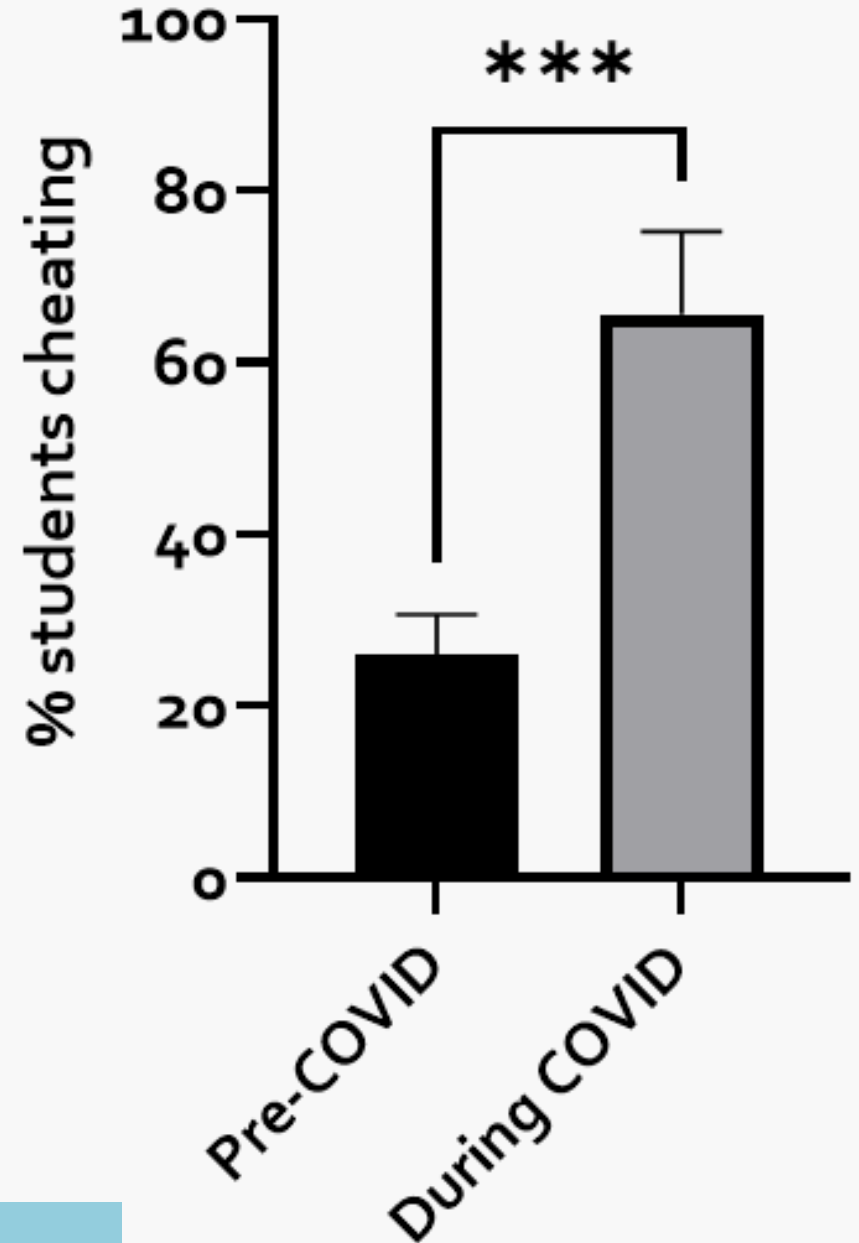
- It's easy to do
- It works
- Others are cheating
- Rules and consequences are unclear
- Strong incentives
 - Fear of failure, struggling academically, financial pressure, competition
- Life - Stressors, distractors, pressures, etc

Academic misconduct is more likely when...

- It's easy to do
- It works
- Others are cheating
- Rules and consequences are unclear
- Strong incentives
 - Fear of failure, struggling academically, financial pressure, competition
- Life - Stressors, distractors, pressures, etc

**Cheating is more common in
online exams**

**ChatGPT(4) passes MCQ exams
Does even better on essays**



Picking an authentic assessment format

- **Which format is the most authentic?**
- (Assume everything else is equal, as far as possible)
- Which one represents the world of work?
- How would you know
- How would you improve authenticity



Which is the most authentic?

Multiple Choice Question Exams

Essays (Asynchronous Coursework)

Presentations

Practical Assessments

Workplace-Based Assessment



Which is the most authentic?

Workplace-Based Assessment



Practical Assessments



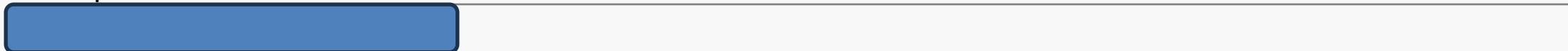
Presentations



Essays (Asynchronous Coursework)



Multiple Choice Question Exams



Picking an authentic assessment format

- **Which format is the most authentic?**
- (Assume everything else is equal, as far as possible)
- Which one represents the world of work?
- How would you know
- How would you improve authenticity

Picking a manageable assessment format

- **Which format takes the longest to mark?**
- (Assume everything else is equal, as far as possible)
- *Why* does it take so long (or not)
- How would workload be improved



Which takes the longest time to mark?

Multiple Choice Question Exams

Essays (Asynchronous Coursework)

Presentations

Practical Assessments

Workplace-Based Assessment



0

Which takes the longest time to mark?

Multiple Choice Question Exams

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Workplace-Based Assessment

Picking a manageable assessment format

- **Which format takes the longest to mark?**
- (Assume everything else is equal, as far as possible)
- *Why* does it take so long (or not)
- How would workload be improved

Picking an 'enjoyable' assessment format

- **Which format do students enjoy most?**
- (Assume everything else is equal, as far as possible)
- You are assessing a group of students on a learning outcome relevant to your course. You have designed 5 different assessments of the assessment and you allow students to pick the format of the assessment that they prefer. Which one will they pick?



Which do students enjoy the most?

Multiple Choice Question Exams

Essays (Asynchronous Coursework)

Presentations

Practical Assessments

Workplace-Based Assessment

All other things being equal, which would they pick?



Which do students enjoy the most?

Practical Assessments



Workplace-Based Assessment



Multiple Choice Question Exams



Essays (Asynchronous Coursework)



Presentations



Write two Learning Outcomes

Make them SMARTIE

Align an Assessment

Valid and.....

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

Two per table one each for novices and advanced

- Specific – what is the Learning Outcome
- Measureable – how will you assess it
 - What resources will you need
 - How will you ensure validity and reliability
 - How will you secure assessment security
- Achievable – how will you know it has been achieved
- Relevant
- Time-Bound – how long will they need
- Inclusive – can everyone access it? Is it fair?
- Evident – how will the outcome, and the learning, be visible

Summary

- Assessment design requires validity
- All else is pragmatic choices

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***Specific, Measurable, Achievable, Relevant,
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- Champion Bunde 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](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

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Questions?

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