

Leveraging How we Learn:

Retrieval Practice Strategies for Nursing Students

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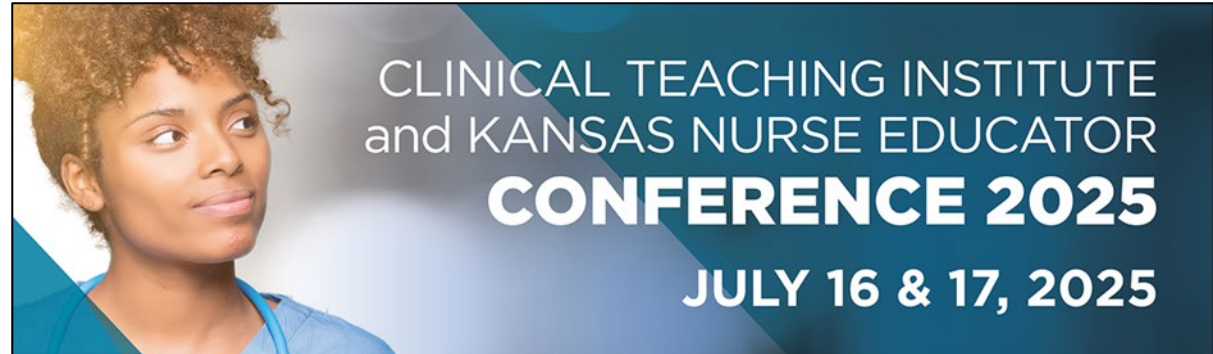
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COI Disclosure

The presenter has no financial conflicts of interest to disclose concerning this presentation





Introduction



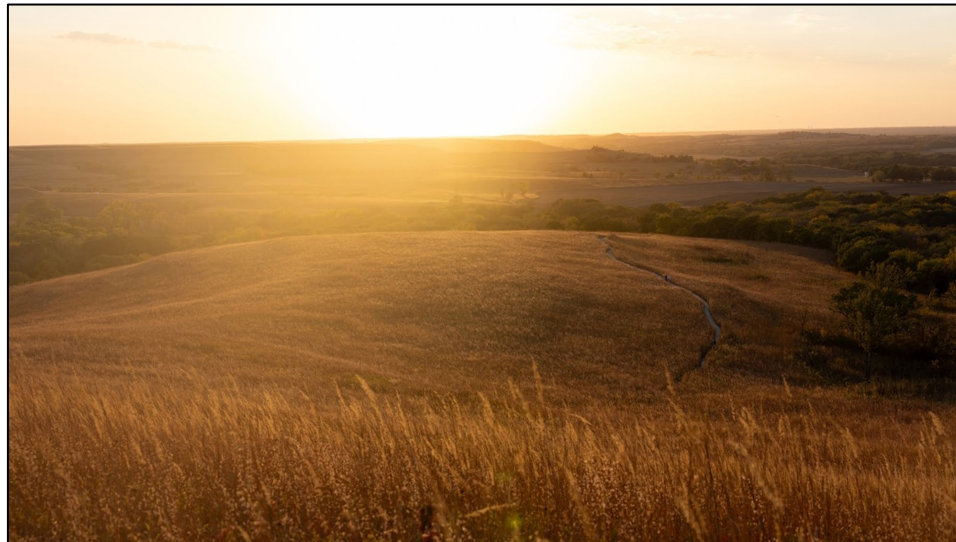
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Goals of the session:

To share evidence from the learning science and health professions education literature about the most studied and most powerful neurocognitive learning strategy, retrieval practice (RP).

To provide details about specific strategies and practical implementation with practice opportunities for educators.



Objectives

Participants will:

1. Identify Retrieval Practice (RP) strategies supported by research
2. Practice RP strategies facilitated by the presenter
3. Explore implementation of RP strategies in academic settings



Background



The Problem

- New graduate RNs are unprepared (Kavanaugh & Sharpnack, 2021).
- Underdeveloped clinical judgment → preventable errors; incidents of failure to rescue (Kavanaugh & Sharpnack, 2021; Kiernan, 2018; Saintsing et al., 2011; Song & Kim, 2023).
- Unfamiliar contexts, complex patient situations, high stress, little experience
- Lack of foundational knowledge retained from professional training







Neurocognitive Strategies for Learning?

- Working with the way the brain is designed to learn
- Learning Science (aka BBL) : neurocognitive research, educational psychology (Agarwal, 2019; Onello & Moulton, 2020; Weinstein et al., 2018).
- Strategies: retrieval practice, spaced practice, interleaving, elaboration, generation, and reflection (Agarwal & Bain, 2019; Agarwal & Roediger, 2018; Brown et al., 2014; Dunlosky et al., 2013; Van Hoof & Doyle, 2018; Weinstein et al., 2018).

LEVERAGE



What is Retrieval Practice?

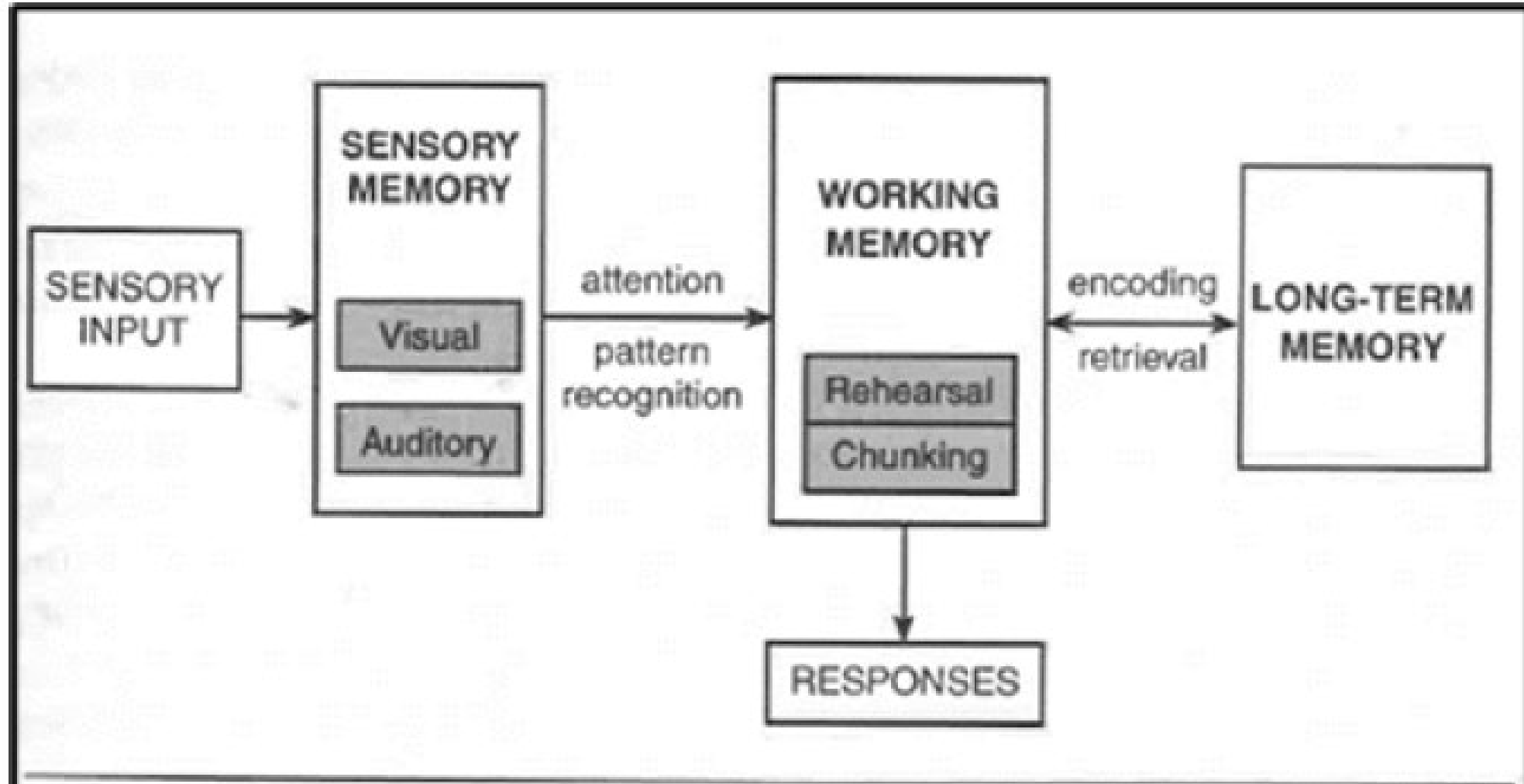
The most-studied neurocognitive strategy for learning with greatest support in evidence!

(RP) = an evidence-based neurocognitive strategy that uses test-enhanced learning to improve knowledge acquisition and retention, resulting in durable learning (Agarwal & Bain, 2019; Ghanbari et al., 2019; Pan et al., 2024; Van Hoof & Doyle, 2018).



Figure 2

Information Processing Theory

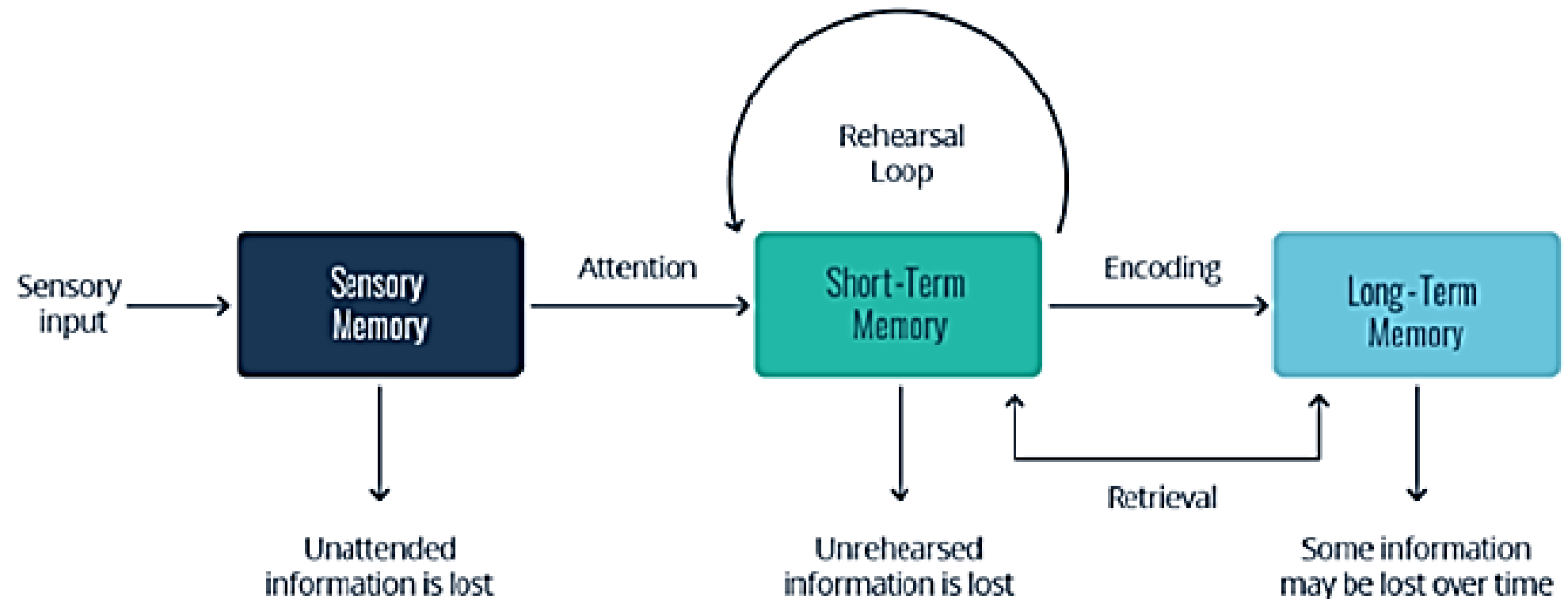


Note. Driscoll, M. P. (2005). *Psychology of learning for instruction* (3rd ed.). Pearson Education, Reprinted with Permission



Figure 1

The Multi-Store Model of Memory



Note. Cloke, H. (2024). *The multi-store model of memory* [Image]. Growth Engineering.

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Why Retrieval Practice?

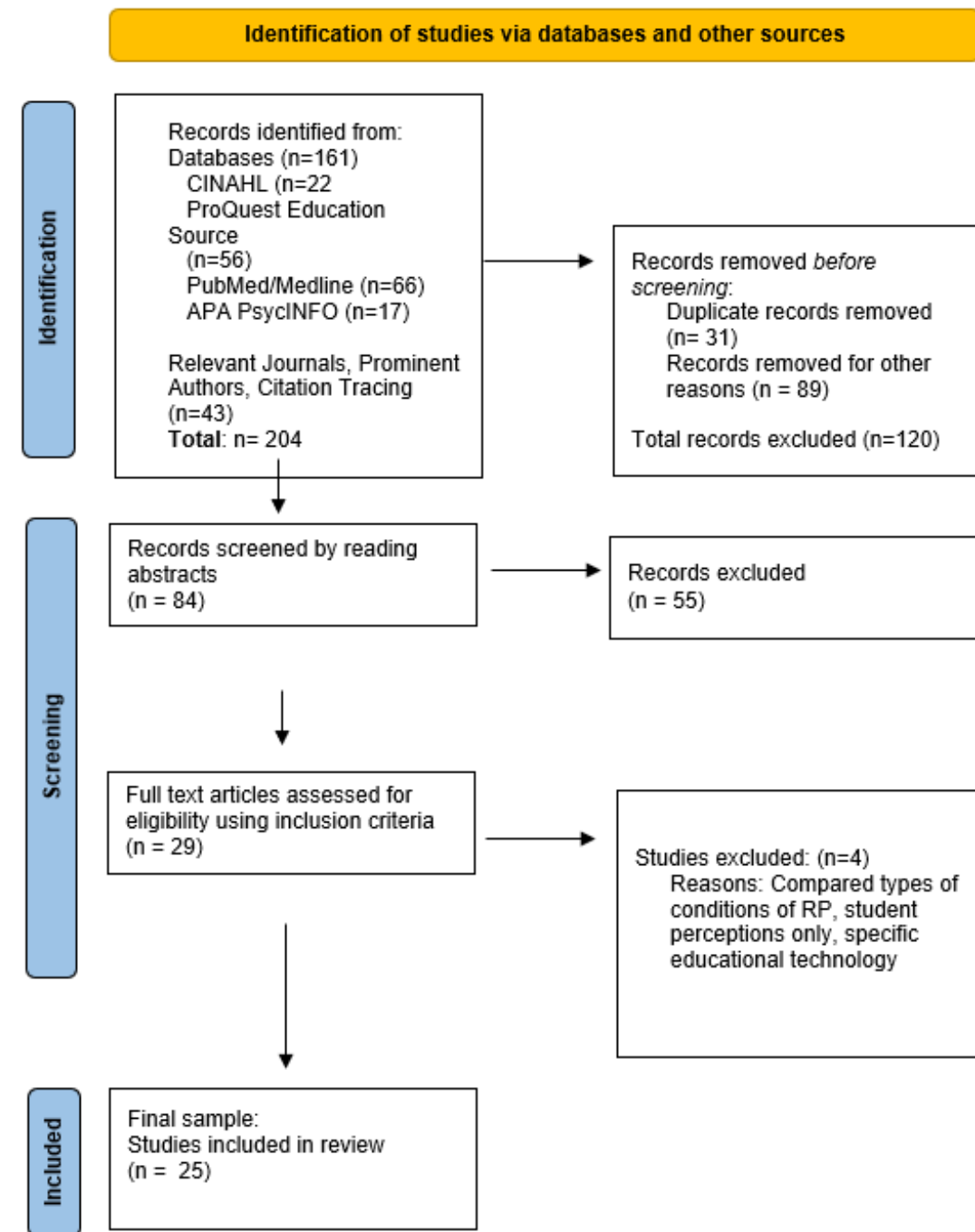
- Research in Ed Psych (K-12, Higher Ed) and Health Professions Ed (Agarwal et al., 2021; APA, 2020; Green et al., 2018; Van Hoof et al., 2023).
- Promotes transfer of knowledge to varied contexts and settings, including clinical settings (Agarwal et al., 2021; Butler, 2010; Dobson et al., 2019; Green et al., 2018; Larsen et al., 2013; Pan & Rickard, 2018; Wang & Yang, 2024).
- Inherent to patient care (Nelson & Eliaz, 2023).

Literature Review



Methods

- Lit search of studies about RP strategies used in HPE over past 20 years
- Final sample (n=25) studies reviewed
 - 5 lit reviews
- **Synthesis:** characteristics of RP strategies; effectiveness compared to traditional methods, types, frequency, interval





Results: Synthesis of HPE Literature

- Formative use of RP more effective than traditional study methods
 - RP strategies yield similar results
 - Transfers beyond exams to clinical settings
 - Protects memory against stress on retrieval
 - Specific strategies and characteristics
 - Frequency and interval matters
 - Desirable difficulty essential
-
- RP demonstrates potential (acquisition and durable learning) of *nursing-specific* knowledge
 - More research needed!



Retrieval Practice Strategies:

- Low/No stakes formative quizzing (MCQ and SAQ) with rationales/feedback
- Free Recall
- Cued Recall
- Closed-book self-quizzing (MCQ and SAQ)
- RP using case studies
- Read-test-read-test retrieval pattern
- Quizzing with a partner/feedback
- Spaced repetition



Intervention Example:

Lunchtime workshop sessions to teach & practice 8 RP strategies

Participants (n=40)

- 100% reported using at least 1 RP strategy for exam prep over the subsequent 9 weeks
- All strategies used at least 10 times by at least one participant (36-109)
- Quizzing w/partner (92%; Free recall (79%); Closed-book self-quiz MCQ (74%)

Value and relevance of RP for learning and exam preparation

Similar results with med students; student buy-in class to home study

- RP outside of class; scored higher on exams





Implications

- RP strategies can be used in the classroom, by learners for individual study, success coaching

Recommendations:

- RP in the classroom to (calibrate learning)
- RP for individual study exam prep/remediation
- Provide opportunities to practice quizzing aloud with a partner and providing feedback (classroom exercises, study skills workshops, educational support services, success coaches)
- Practice closed-book self-quizzing with rich-context MCQ (above knowledge level) in class or supplemental settings



Learning Activity





Retrieval Practice Strategies:

- Free Recall
- Cued Recall
- Closed-book self-quizzing (MCQ and SAQ)
- Low/No stakes formative quizzing (MCQ and SAQ) with rationales/feedback
- RP using case studies
- Read-test-read-test retrieval pattern
- Spaced repetition
- Quizzing with a partner/feedback



Free Recall =

Attempt to remember previously studied information in any order, without any cues; goal 6-12 sentences

“What can you remember about the different types of dysrhythmias?”

“What can you remember about the different ways AI is being used in healthcare?”

2-3 min recall

After: use notes from class/text to check for accuracy and thoroughness; make corrections and additions

Cued Recall =

Retrieving information from long-term memory using cues such as words, letters, numbers, or pictures; cues guide sequencing.

Cued Prompt #1: For each dysrhythmia, list at least 2 each: risk factor, symptom, treatment

- Sinus bradycardia
- Sinus tachycardia
- Supraventricular tachycardia
- Atrial fibrillation
- Atrial flutter
- Ventricular tachycardia
- Ventricular fibrillation

Cue every 5-10 min

After: Use notes from class/text to check for accuracy/thoroughness; make corrections and additions



Cued Prompt #2: Explain your actions for the steps of EKG interpretation:

1. Rate (A or V)
2. Rhythm(Reg or Irreg)
3. P wave
4. PR interval
5. QRS duration
6. ST segment
7. T wave
8. QT interval

Cue every 5-10 min

After: Use notes from class/text to check for accuracy/thoroughness; make corrections and additions

Cued Prompt #3: Describe how you would operationalize these steps for prompt engineering:

1. Task
2. Context
3. References
4. Evaluate
5. Iterate

Closed-book self-quizzing (Short Answer)=

Using short answer questions that cover course content to test mastery and highlight weak areas for further study (individual; written or aloud)

Quiz closed book 1-3 days after studying, then calibrate study (accuracy, thoroughness).

Use course objectives as prompts for short answer responses

“Why are medications erythropoietin and phosphorous binders prescribed to CKD (chronic kidney disease) patients?”

“How can you set expectations for ethical AI use in your course, guiding students to use AI responsibly?”

(In class or submit): After, provide a key/feedback about why answers are correct/incorrect and what is missing.



Closed-book self-quizzing (Multiple Choice Questions)=

Using MCQs that cover course content to test mastery and highlight weak areas for further study (individual; written)

- *Quiz closed book 1-3 days after studying, then calibrate study based on correct answers/feedback*
- *MCQ quiz items should be context-rich mixed with factual recognition; provide key with rationales and/or discussion*
- *Students can write or find questions; use GAI; textbook resources; UWorld; ATI (study mode)*
- *Feedback/rationales are essential! Why is this the correct answer?*

Factual recognition MCQ:

1. Which of the following assessments is most appropriate for determining correct placement of an endotracheal tube (ETT) after intubation?
 - a) Assessing patient's skin color and chest x-ray
 - b) Verification of ETT cuff inflation and end-tidal CO₂
 - c) Auscultation of bilateral breath sounds and chest x-ray
 - d) Confirmation with chest x-ray and end-tidal CO₂

Rationale: Assessments of skin color, respiratory rate and the amount of cuff inflation cannot validate the placement of the endotracheal tube. The position of the endotracheal tube is verified by checking end-tidal carbon dioxide levels and confirmed with chest x-ray.

Application/Context-rich MCQ:

2. A 30-year-old woman delivered her third child via vaginal birth 6 hours ago. Upon assessment, the nurse notes heavy vaginal bleeding, with a boggy uterus that is displaced to the right. From the choices below, select the most likely cause for the bleeding and the most appropriate initial action for the nurse to take.

Possible Causes	Initial Action by the Nurse
Full bladder	Administer intravenous oxytocin to promote uterine contractions.
Retained placental fragment	Prepare the patient for an emergency hysterectomy
Depleted clotting factors	Perform a uterine massage and assist the patient to empty her bladder.
Uterine muscle fatigue	Apply external pressure to the perineum to control the bleeding

Rationale: Postpartum hemorrhage (PPH) can be exacerbated by uterine atony, where the uterus fails to contract effectively after delivery, leading to excessive bleeding. A boggy uterus and displacement to the right suggest uterine atony, potentially caused by a full bladder. A full bladder can prevent the uterus from contracting properly and contribute to uterine displacement. Initial management involves performing a uterine massage to stimulate contractions and assisting the patient to empty her bladder. This can help the uterus contract more effectively and reduce bleeding. Administering intravenous oxytocin may also be considered, but addressing the full bladder is a crucial first step.

3. A 58-year-old female patient presents to the emergency department with palpitations and dizziness. Her EKG shows the following characteristics: Irregularly irregular rhythm; No distinct P waves; Narrow QRS complexes

Based on this EKG interpretation, which of the following is the most likely diagnosis, and what is the initial management step? Choose one option from each column below:

(EKG interpretation)	Initial management Step	Expected outcome of intervention
Ventricular tachycardia	Administer beta-blocker or calcium channel blocker	Depolarization of heart muscle pauses cardiac activity to restore natural rhythm
Atrial fibrillation	Perform synchronized cardioversion	Restores normal rhythm when medications are ineffective
Sinus tachycardia	Provide reassurance; continue to monitor	Reduction of impact of psychological triggers
Atrial flutter	Prepare for immediate defibrillation	Control ventricular rate

Rationale: The EKG characteristics described (irregularly irregular rhythm, absence of distinct P waves, and narrow QRS complexes) are indicative of atrial fibrillation (AFib). AFib is a common dysrhythmia that can cause palpitations, dizziness, and an increased risk of stroke. Initial management of AFib typically involves controlling the ventricular rate to alleviate symptoms and prevent complications. This can be achieved with medications such as beta-blockers (e.g., metoprolol) or calcium channel blockers (e.g., diltiazem). In some cases, anticoagulation therapy may also be necessary to reduce the risk of thromboembolism.



Closed-book self-quizzing with Case Studies = Using a case study or clinical example for context-based retrieval

- Provide case study or clinical example; give time for students to create care plan, explain decision making, or describe patient teaching
- Retrieve at appropriate intervals with rationales to practice noticing, interpreting, responding with feedback/corrections for accuracy
- Provide additional prompts with slightly different contexts (setting, age group, social determinants, etc.) for practice

History and Physical

Vital Signs

Lab's / Diagnostic Tests

08/1/22 0700 Patient is 25-year-old female brought to the emergency room via ambulance following a motor vehicle accident (MVA) this morning at 0500. Patient is pregnant and at 38-weeks and 2-days gestation. Upon arrival patient was noted to have a placental abruption which resulted in an emergency C-section. Blood loss was estimated at 300 mL. No complications noted in the post-surgical recovery. Blood on surgical dressing, noted at 2 cm and circled with pen, time was 0600.

1430: Assessment:

- Neuro – Drowsy. Oriented to person and place, but not to time. Wakes to stimuli, but falls back to sleep immediately. Patient states, “I want to be left alone.” HEENT: Mucous membranes pink. Bleeding noted from gums.
- Integumentary – Skin is pale and cool to touch. Bleeding noted from left forearm peripheral IV. Petechiae noted under blood pressure cuff.
- Cardiovascular – Cap refill 4 seconds. Diminished peripheral pulses.
- Respiratory – All lobes are clear to auscultation, accessory muscles used during inspiration.
- GI – Abdominal wound dressing intact, blood extends 3cm beyond circle noted from 0600. Bowel sounds are absent. Fundus at -1. Last bowel movement over 24-hours ago.
- GU – Foley catheter present – urine is light brown in color; heme test is positive. Moderate bleeding noted to peri-pad. Patient changed pad 1400 and again at 1415 due to heavy bleeding.



1. Which findings require immediate follow-up?

Drowsy, oriented to person and place, but not to time. Wakes to stimuli, but falls back to sleep immediately. Bleeding noted from gums. Skin is pale and cool to touch. Bleeding noted from left forearm peripheral IV. Petechiae noted under blood pressure cuff. Cap refill 4 seconds. Diminished peripheral pulses. accessory muscles used during inspiration blood extends 3cm beyond circle noted from 0600. urine is light brown in color; heme test is positive. Moderate bleeding noted to peri-pad. Patient changed pad 1400, and again at 1415 due to heavy bleeding.

2. What is the clinical diagnosis?

DIC (disseminated intravascular coagulopathy)

3. What risk factors does Ms. Williams have for DIC?

Trauma (MVA), OB complication: placental abruption, Recent surgery (C-section)

4. What lab reports are significant?

5. What needs follow up by the RN and/or provider?

6. How would the nurse's priorities be different if the patient were ____?

Closed-book self-quizzing with Case Studies = Using a case study or clinical example for context-based retrieval

You are teaching a foundations of nursing course this semester. Students are struggling to master content for course exams. How can you leverage AI to address this problem?

Read-test-read-test retrieval pattern=

Reading material for 2-5 minutes followed by quizzing 2-3 items then repeated pattern twice



It's quick when you have just a little time!

Coached R-T-R-T pattern in class with readings interspersed with test/quiz questions over 15-20 min

Encourage students to practice pattern in personal study time using a timer

Spaced Repetition=

Retrieval of information at least 1-3 days after studying; repeated every 2 days or 3 retrievals in 7 days

- *Desirable difficulty comes from effortful remembering*
- *2-3 day interval*
- *In class or assigned work with deadlines*
- *Students replicate Q2 or 3 in 7 at home*



Shorter (30-45 min) repeated study sessions are more effective (and less painful!)

- *Trust the process...*



Quizzing with a partner =

quizzing aloud with a partner who provides feedback/correction and rationales for your answers

In class: Students work in pairs to retrieve information from previous course material (at least 2 days ago)

- *Student 1 answers prompts with rationales*
- *Student 2 responds with feedback/corrections/missing information*

At home: practice in pairs



Final Thoughts:

Could you implement these strategies in your

- classroom?
- academic supports programs?
- exam prep/study help?
- success coaching?

What barriers do you see?

How can I help?



Questions?



Evidence-based Resources on RP:

Websites:

<https://www.retrievalpractice.org/> (Dr. Pooja Agarwal)

<https://www.learningscientists.org/> (Dr. Megan Sumeracki)

Books:

American Psychological Association. (2020). *The APA guide to college teaching: Essential tools and techniques based on psychological science.*

<https://www.apa.org/ed/precollege/undergrad/college-teaching-guide>

Agarwal P.K. (2025). *Smart Teaching: Stronger Learning: Practical Tips From 10 Cognitive Scientists.* Unleash Learning Press. **ISBN 979-8991819107**

Agarwal, P. K., & Bain, P. M. (2019). *Powerful teaching: Unleash the science of learning.* Jossey-Bass. <https://doi.org/10.1002/9781119549031>

Brown, P. Roediger H. & McDaniel M. (2014). *Make it stick: The science of successful learning.* Belknap Press of Harvard University Press. **ISBN 978-0674729018**

Evidence-based Resources on RP:

Systematic Reviews:

Agarwal, P. K., Nunes, L. D., & Blunt, J. R. (2021). Retrieval practice consistently benefits student learning: A systematic review of applied research in schools and classrooms. *Educational Psychology Review*, 33, 1409–1453.

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Thank you!

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