

Using AI to Enhance the Application of Cognitive Science Learning Principles in the Classroom



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Prompts

- Be clear about level of student
- Learning objectives
- Use cognitive science terms
- The more specific prompt, the better the outcome

"Create interactive learning activities with assessment using neuroscience principles (retrieval, interleaving, spacing, metacognition) for a senior level nursing student in critical care on arrhythmias and cardiac output. Include AI in the some of learning activities. Learning objectives: Identify cardiac rhythms. Compare and contrast arrhythmias. Prioritize nursing interventions. Explain how alterations in preload, afterload, contractility, and heart rate affect cardiac output in critically ill patients."

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Fundamental Lesson on Dosage and Calculations

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Prompt example

- **First prompt-** -Create an example for a faculty in nursing education teaching dosage and calculation using interleaving in cognitive science
 - not specific enough- Teach nursing students to accurately calculate medication dosages using various methods (e.g., ratio-proportion, dimensional analysis, formula method) and across different contexts (oral, IV, weight-based)
- **Second Prompt-** Use this idea but create an interleaving assignment using just dimensional analysis
- Excellent — so now you want an interleaving assignment that focuses only on dimensional analysis but still applies the cognitive principle of interleaving (mixing problem types and contexts).
- That's a great design move — because even within a single calculation method (dimensional analysis), you can interleave across contexts, units, and complexity levels to help students learn when and how to flexibly apply the same reasoning structure.

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Focus Skill: Applying dimensional analysis correctly and flexibly across medication contexts

Learning Objectives:

- Convert and calculate medication dosages accurately using dimensional analysis.
- Recognize contextual cues that affect unit setup and conversion.
- Strengthen transfer of dimensional analysis across varied dosage situations.

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Assignment Overview:

- Students will complete a mixed set of dosage problems.
- All use dimensional analysis, but the context, units, steps, and clinical purpose vary.
- This interleaving helps learners move beyond "plug-and-chug" toward conceptual mastery.

Directions:

- Solve each problem using dimensional analysis.
- For each, clearly:
 - Set up your conversion factors.
 - Cancel units step by step.
 - Identify the final answer and check for clinical reasonableness.
 - Reflect briefly (1–2 sentences): What cues told you how to set it up?

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Oral Medication (Simple Conversion)

- The order reads: Acetaminophen 650 mg PO every 6 hours.
- Available: Acetaminophen 325 mg tablets.
- How many tablets should the patient receive per dose?

IV Infusion (Flow Rate Conversion)

- The provider orders 1,000 mL of Normal Saline over 8 hours.
- IV tubing delivers 15 gtt/mL.
- Calculate the flow rate in drops per minute (gtt/min) using dimensional analysis

IV Drip- Multi Step

- Order: Dopamine 5 mcg/kg/min for a 70-kg patient.
- Available: Dopamine 400 mg in 250 mL D5W.
- Calculate the infusion rate in mL/hr.

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Weight-Based Pediatric Dose

- The order reads: Amoxicillin 25 mg/kg/day PO divided q12h.
- The child weighs 36 lb.
- Available: Amoxicillin 125 mg/5 mL suspension.
- How many milliliters should be given per dose?

Injectable Medication (Concentration Adjustment)

- Order: Heparin 7,500 units subcutaneously.
- Available: Heparin 10,000 units/mL.
- How many milliliters will you administer?

After completing all problems, respond:

- Which problem type was hardest to set up? Why?
- What cues help you decide where to place your conversion factors?
- How did switching between contexts (oral, IV, weight-based) affect your reasoning?

• Faculty Implementation Notes

- Format: Use as in-class group work or online submission.
- Scaffolding: Start with 2 problems during class, then assign the rest for practice.
- Feedback Focus: Clarity of setup and justification — not just numerical accuracy.
- Cognitive Rationale
 - Interleaving across contexts strengthens pattern recognition.
 - Retrieval and self-explanation enhance transfer to clinical situations.

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Fundamental Lesson on Oxygenation and Perfusion

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Prompt

Create interactive learning activities with assessment using neuroscience principles (retrieval, interleaving, spacing, metacognition) for a fundamental lesson on oxygenation and perfusion

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Learning Objectives

By the end of the lesson, learners should be able to:

- Define oxygenation and perfusion.
- Describe the physiological mechanisms involved.
- Identify factors that affect oxygenation and perfusion.
- Apply knowledge to clinical scenarios.

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"Concept Match & Recall" (Retrieval + Interleaving)

Format: Interactive drag-and-drop or flashcard tool.

Instructions:

- Match terms like *oxygenation*, *perfusion*, *hemoglobin*, *cardiac output*, *alveoli*, *capillary exchange* to their definitions.
- After matching, learners answer 3 short-answer questions:
 - "What is the difference between oxygenation and perfusion?"
 - "How does hemoglobin contribute to oxygenation?"
 - "What happens to perfusion during shock?"

Assessment:

- Auto-feedback with explanations.
- Learners rate their confidence before and after each question.

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“Case Study Carousel” (Interleaving + Retrieval)

Format: Rotating clinical scenarios.

Instructions:

- Learners rotate through 3 short patient cases:
 - COPD exacerbation
 - Acute myocardial infarction
 - Hypovolemic shock
- For each case, learners answer:
 - “Which is primarily affected: oxygenation or perfusion?”
 - “What clinical signs support your answer?”
 - “What interventions would improve the condition?”

Assessment:

- Multiple-choice and short-answer.
- Peer comparison or instructor feedback.

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“Spaced Quiz Series” (Spacing + Retrieval)

Format: Scheduled quizzes over 3 days.

Instructions:

- Day 1: Basic definitions and mechanisms.
- Day 2: Application to clinical signs and symptoms.
- Day 3: Mixed review with higher-order thinking.

Assessment:

- Each quiz includes:
 - 5 Multiple Choice Questions
 - 2 fill-in-the-blank
 - 1 scenario-based question
- Learners receive performance tracking and concept reinforcement.

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Bonus Activity: “O₂ & Perfusion Escape Room”

Format: Gamified challenge.

Instructions:

- Learners solve puzzles to “rescue” a patient.
- Each puzzle involves:
 - Interpreting ABGs
 - Identifying perfusion deficits
 - Choosing correct oxygen delivery methods

Assessment:

- Points earned for correct answers and rationale.
- Final debrief with missed concepts reviewed.

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“Think-Aloud Diagnostic Walkthrough” (Metacognition)

Format: Interactive video or simulation with embedded reflection prompts.

Scenario Presentation:

Learners are shown a short clinical vignette (e.g., a patient with dyspnea and low SpO₂).

Think-Aloud Prompts (Metacognitive Reflection):

At key decision points, learners are asked:

- “What do you *think* is happening physiologically?”
- “How confident are you in your answer?”
- “What information would help you feel more certain?”
- “What alternative explanations could there be?”

Decision-Making Task:

Learners choose a diagnostic or treatment path (e.g., administer oxygen, order ABGs, assess perfusion).

Feedback & Self-Evaluation:

After each decision, learners receive:

- Correct answer with rationale.
- A prompt: “Was your reasoning accurate? What would you do differently next time?”

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Bonus: Metacognitive Self-Assessment Quiz

- Learners rate their understanding of:
 - Oxygenation vs. perfusion mechanisms.
 - Clinical signs of impaired oxygenation/perfusion.
 - Confidence in applying knowledge to patient care.
- Include Likert-scale questions and open-ended reflections:
 - "What concept do you feel least confident about?"
 - "What strategy will you use to reinforce this concept?"

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Oxygenation & Perfusion: Foundations of Life-Sustaining Care

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Prompt

Create interactive learning activities with assessment using neuroscience principles (retrieval, interleaving, spacing, metacognition) for a fundamental lesson on oxygenation and perfusion **using AI** for activities

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Learning Objectives

Students will:

- Describe the physiological mechanisms of oxygenation and perfusion
- Apply clinical reasoning to assess and intervene in oxygenation/perfusion deficits
- Use AI tools to simulate, critique, and reflect on care strategies
- Strengthen retention and metacognition through spaced, interleaved, and retrieval-based activities

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AI-Prompted Retrieval Quiz – “Vital Concepts Check”

Instructions:

- Students use AI to generate a 10-question quiz on oxygenation and perfusion fundamentals (e.g., gas exchange, hemoglobin transport, cardiac output, SpO₂ interpretation).
- They take the quiz, then prompt AI to explain each answer—correct or incorrect.

Assessment:

- Submit quiz results and AI explanations
- Faculty assess accuracy and depth of understanding

Reflection Prompt:

- “Which concepts felt most intuitive? Which required deeper review—and why?”

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Interleaved Case Analysis – “O₂ & Perfusion in Diverse Patients”

Instructions:

- Students rotate through 3–4 AI-generated patient scenarios:
 - A post-op patient with shallow breathing
 - A child with asthma exacerbation
 - An older adult with heart failure
 - A trauma patient with hemorrhagic shock

Task:

- For each case, students:
 - Identify oxygenation and perfusion concerns
 - Prioritize nursing interventions
 - Use AI to simulate SBAR communication or patient teaching

Assessment:

- Submit a comparative chart or decision matrix
- Faculty assess clinical reasoning and adaptability

Reflection Prompt:

- “How did switching between cases challenge your thinking? What patterns did you notice?”

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Spaced AI Journaling – “O₂ & Perfusion Through Time”

Instructions:

- Over 3 weeks, students engage in short AI-assisted journaling sessions:
 - Week 1: Explore oxygenation and perfusion physiology
 - Week 2: Reflect on a clinical experience or simulation involving respiratory or cardiac compromise
 - Week 3: Draft a personal care philosophy for supporting oxygenation and perfusion

AI Role:

- Acts as a journaling coach, offering prompts, summaries, and reframing suggestions

Assessment:

- Submit weekly entries and final synthesis
- Faculty assess depth, integration, and professional voice

Reflection Prompt:

- “How has your understanding of oxygenation and perfusion evolved? What values guide your approach to respiratory and cardiac care?”

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Weekly Reflections with AI

- Welcome to your personal journaling space, Bonnie! Each week, you can share your thoughts, experiences, challenges, and reflections here. Whether it's about your work as a Product Content Strategist, your exploration of AI in education, or anything else on your mind, this is your space.
- Week 1 Start by sharing your thoughts, experiences, or questions from this week. What stood out to you? What are you curious about?
- Week 2 Continue your journey. Reflect on any changes, new insights, or challenges you encountered this week.
- Week 3 What progress have you made? What are you learning about yourself, your work, or AI?
- Week 4 Wrap up the month with a summary of your experiences. What are your key takeaways? What would you like to explore next?
- Feel free to add more weeks as you go. I'm here to support your reflections and help you make sense of your journey!

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Our try at AI Journaling

- I think it's too much to add to the slide-sure-perhaps we can try and talk around it
- My husband uses it as a coach for ideas.

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Metacognitive AI Dialogue – “Thinking Through the Vitals”

Instructions:

- Students engage in a structured AI conversation using prompts like:
 - “What does a drop in SpO₂ tell me about gas exchange?”
 - “How do I differentiate between oxygenation and perfusion deficits?”
 - “What biases or assumptions do I bring to respiratory assessments?”

AI Role:

- Acts as a nonjudgmental coach, offering clarifying questions, summaries, and feedback

Assessment:

- Submit transcript or synthesis of the dialogue
- Faculty assess clarity, insight, and growth

Reflection Prompt:

- “What surprised you about your own thinking? How will you continue to refine your clinical judgment?”

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Bonus: AI vs. Textbook – “Whose Explanation Resonates?”

Instructions:

- Students compare a textbook explanation of oxygenation/perfusion with an AI-generated one
- Analyze clarity, accuracy, and emotional resonance
- Discuss implications for patient education and digital health literacy

Assessment:

- Submit a short essay or infographic
- Faculty assess critical thinking and synthesis

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Grading Rubric

Criteria	Excellent (25 pts)	Proficient (20 pts)	Developing (15 pts)	Needs Improvement (10 pts)
Clarity & Accuracy of Comparison	Clearly articulates differences in clarity, accuracy, and tone between AI and textbook explanations; uses specific examples	Identifies key differences with mostly accurate comparisons	Basic comparison with limited detail or minor inaccuracies	Vague or inaccurate comparison; lacks specific examples
Analysis of Emotional Resonance	Thoughtfully explores how each explanation affects understanding, empathy, and patient engagement	Addresses emotional tone and impact with moderate insight	Mentions emotional aspects but lacks depth or connection to patient experience	Omits emotional analysis or provides superficial commentary
Implications for Patient Education	Insightfully discusses how explanation style affects patient comprehension, trust, and health literacy	Addresses implications with some connection to patient education	Basic discussion of implications; may miss key connections	Little or no discussion of relevance to patient education
Critical Thinking & Synthesis	Demonstrates high-level reasoning, integrates multiple perspectives, and reflects on broader implications	Shows logical thinking and some synthesis of ideas	Limited synthesis; mostly descriptive or one-sided	Minimal critical thinking; lacks integration or reflection
Professional Voice & Format	Writing or infographic is clear, engaging, and professional; format enhances understanding	Generally clear and professional; format is appropriate	Some lapses in clarity or professionalism; format may distract	Unclear or unprofessional presentation; format hinders comprehension

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Navigating Ethical Dilemmas in Nursing

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- **Example Dilemma:** A nurse is asked to discharge a patient who is medically stable but lacks safe housing or support.
- **Goal:** Equip students to analyze ethical tensions, apply frameworks, and reflect on their professional responsibilities.

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Retrieval Practice – “Ethics Snapback”

Format:

- Begin with a warm-up quiz or flashcard set covering:
 - ANA Code of Ethics
 - Common ethical principles (autonomy, beneficence, justice, fidelity)
 - Institutional policies and patient rights

Assessment:

- Use a digital quiz platform or peer-led Q&A.
- Include short-answer questions requiring application to the dilemma.

Reflection Prompt:

- “Which ethical principles felt most relevant to this case? How confident were you in recalling them under pressure?”

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Interleaving – “Ethical Crossroads”

Format:

- Present 3–4 dilemmas with overlapping but distinct ethical tensions:
 - Discharging a homeless patient
 - Administering care against a patient's religious beliefs
 - Reporting a colleague's unsafe practice
 - Allocating limited resources in a crisis

Task:

- Students compare and contrast ethical principles, stakeholders, and possible actions.
- Use a decision matrix or ethical reasoning framework.

Assessment:

- Submit a comparative analysis with justification for chosen actions.
- Option for small-group debate or role-play.

Reflection Prompt:

- “How did switching between dilemmas challenge your ethical reasoning? What patterns or tensions emerged?”

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Spacing – “Ethics in Practice Journal”

Format:

- Over 2–3 weeks, students revisit the same dilemma with evolving layers:
 - Week 1: Identify ethical principles and stakeholders
 - Week 2: Explore institutional constraints and nurse advocacy
 - Week 3: Reflect on personal values and professional identity

Assessment:

- Weekly journal entries or discussion posts.
- Final synthesis: a reflective essay or video blog articulating their ethical stance.

Reflection Prompt:

- “How has your perspective shifted over time? What tensions remain unresolved, and why?”

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“Ethical Self-Check” (Metacognition)

Format:

- Students complete a guided self-assessment after each activity:
 - What did I assume?
 - What surprised me?
 - Where did I feel conflicted?
 - What would I do differently next time?

Assessment:

- Use a rubric to evaluate depth of reflection and integration of ethical reasoning.
- Option to include peer feedback or faculty coaching.

Reflection Prompt:

- “What does this dilemma reveal about your values as a nurse? How will you prepare to face similar situations in practice?”

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Bonus: AI-Assisted Ethical Reasoning

- Students use AI to generate a sample ethical analysis or care plan.
- They critique the AI's reasoning, revise it, and reflect on the role of human judgment.

Assessment Extension:

- “How did the AI's response compare to your own? What ethical nuances did it miss or oversimplify?”

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AI Bias Detector-Clinical Scenario Critique

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Prompt

Create interactive learning activities with assessment using neuroscience principles (retrieval, interleaving, spacing, metacognition) for a nursing capstone lesson on bias in clinical decision-making using AI for activities

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Learning Objectives

Students will:

- Identify and analyze bias in clinical decision-making
- Evaluate how bias impacts patient outcomes and trust
- Use AI tools to detect, critique, and revise biased content
- Reflect on their own assumptions and strategies for equitable care

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AI Bias Detector – Clinical Scenario Critique (Retrieval)

Instructions:

- Students prompt an AI to generate a brief care plan or discharge instructions for a patient (e.g., a non-English-speaking older adult, a Black woman with pain, a transgender teen).
- They analyze the AI-generated output for signs of bias, stereotyping, or omission.
- Students revise the content to reflect inclusive, patient-centered care.

Assessment:

- Submit original AI output, annotated critique, and revised version.
- Faculty assess accuracy, cultural humility, and clarity.

Reflection Prompt:

- "What did the AI miss? How did your revision improve the equity and accuracy of the response?"

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Interleaved AI Role Play – Bias Across Contexts

Instructions:

- Students use AI to simulate brief dialogues with diverse virtual patients.
- Rotate through 3–4 cases (e.g., patient with substance use disorder, undocumented immigrant, rural teen with mental health concerns).
- Students ask questions, receive AI-generated responses, and reflect on tone, assumptions, and care implications.

Assessment:

- Submit a comparative chart analyzing bias cues and communication strategies.
- Include one revised dialogue per case.

Reflection Prompt:

- "How did switching between cases challenge your assumptions? What patterns did you notice in AI responses?"

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Spaced AI Journaling – Bias Awareness Tracker

Instructions:

- Over 3 weeks, students engage in short AI-assisted journaling sessions:
 - Week 1: Define and explore types of bias
 - Week 2: Analyze a real-world example (clinical, media, or policy)
 - Week 3: Draft a personal bias mitigation plan

AI Role:

- Students use AI to brainstorm examples, clarify definitions, and refine their reflections.

Assessment:

- Submit weekly entries and final synthesis.
- Faculty assess depth, growth, and ethical insight.

Reflection Prompt:

- "How has your understanding of bias evolved over time? What commitments will you carry into your future practice?"

Metacognitive AI Dialogue – Bias Self-Audit

Instructions:

- Students engage in a structured AI conversation using prompts like:
 - "What assumptions do I hold about pain tolerance across cultures?"
 - "How do I respond when bias is pointed out?"
 - "What strategies help me stay open and accountable?"

AI Role:

- Acts as a nonjudgmental coach, offering questions, summaries, and reframing suggestions.

Assessment:

- Submit a transcript or synthesis of the dialogue.
- Option for peer feedback or faculty coaching.

Reflection Prompt:

- "What surprised you about your own thinking? How will you continue to grow as an equitable care provider?"

Bonus: AI vs. Human Bias – Comparative Analysis

Instructions:

- Students compare a faculty-generated case study with an AI-generated one.
- Identify differences in tone, assumptions, and inclusivity.
- Discuss implications for clinical education and practice.

Assessment:

- Submit a short essay or infographic.
- Faculty assess critical thinking and synthesis.