Designing Learning Experiences That Foster Reflection and Connection Lessons from CHEMISTRY II

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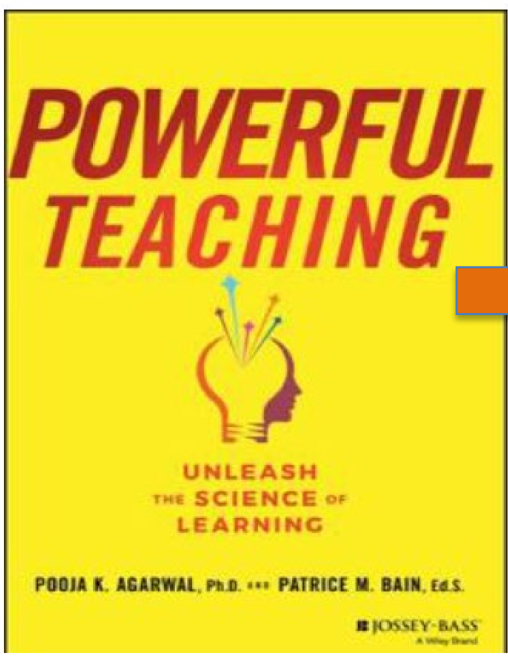
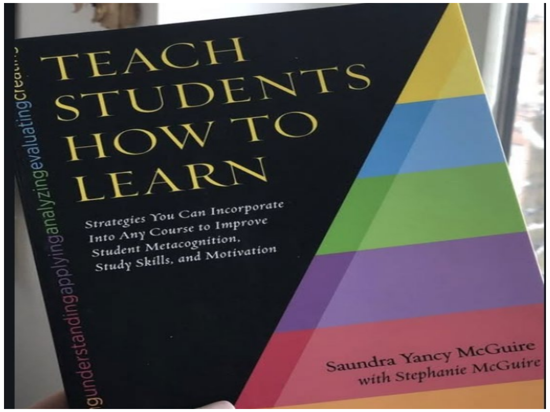
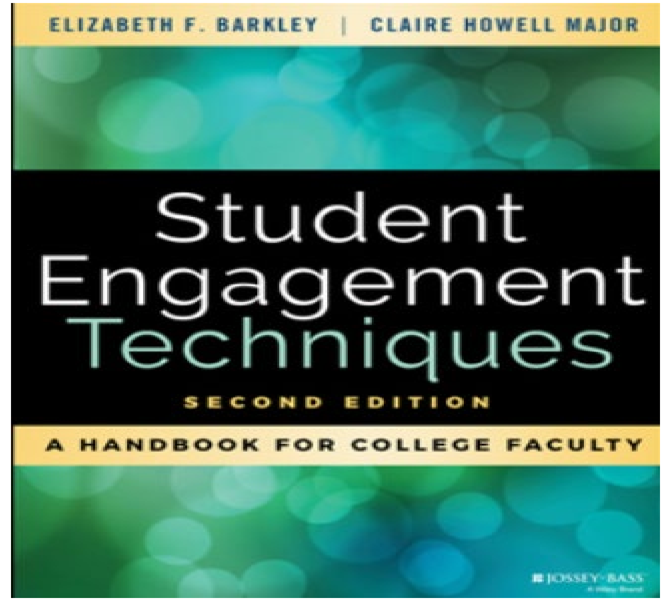
- CHEM II is challenging and often taken by diverse majors
- Your goal: **improve learning, motivation, and metacognition**



- Learning improves through retrieval, spacing, and feedback
- Low-stakes practice strengthens memory and confidence
- Metacognition enhances student self-regulation
- Small instructional changes can yield large learning gains



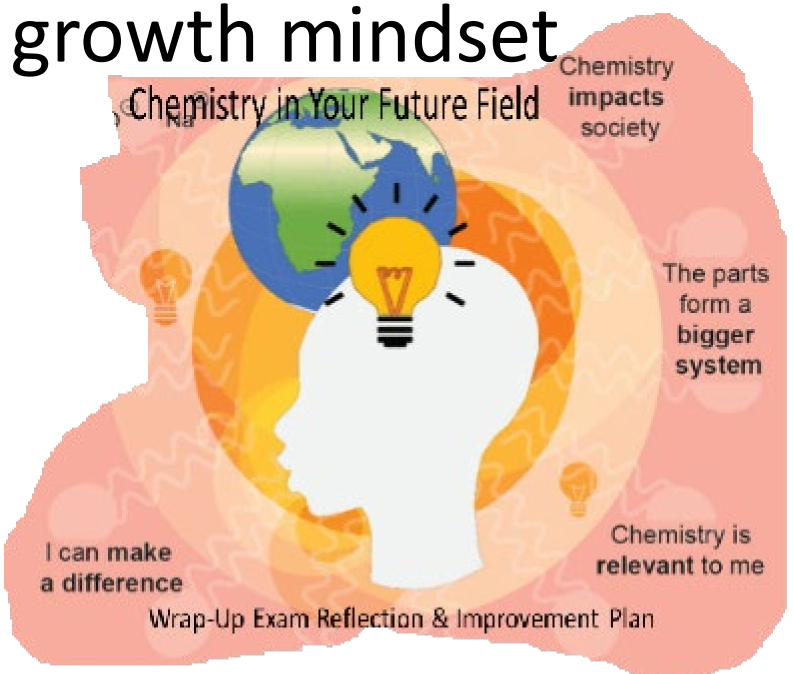
- ✓ **Instructors can dramatically improve student success by teaching metacognitive strategies—helping students understand *how* they learn, *why* certain strategies work, and *when* to use them.**
- ✓ **McGuire also highlights the importance of Bloom's Taxonomy to help students recognize the difference between memorization and deeper levels of learning such as application, analysis, and synthesis. By reframing learning expectations, students shift from a fixed mindset to a growth mindset, taking responsibility for their learning process.**



- **Active learning**
- **Student voice**
- **Reflection and relevance**
- **Inclusive participation**

Why These Projects?

- Students often focus on grades rather than learning
- Limited structured reflection after exams
- Difficulty connecting chemistry to future careers
- SET goals: metacognition, growth mindset relevance



Project 1: Chemistry in Your Future Field

- Small-group presentation project
- Students connected chemistry concepts to intended careers
- Emphasized relevance, communication, and collaboration
- Encouraged interdisciplinary thinking

SET project Section 1 Fall 2025 21868

SET Project Section 2   Fall 2025 20761

Redox Reactions and Antioxidants

Electochemistry and real time health monitoring

Thermodynamics and Air conditioning System

Muscle Integrity and Intermolecular Forces

nuclear chemistry and radioactivity applications in civil engineering

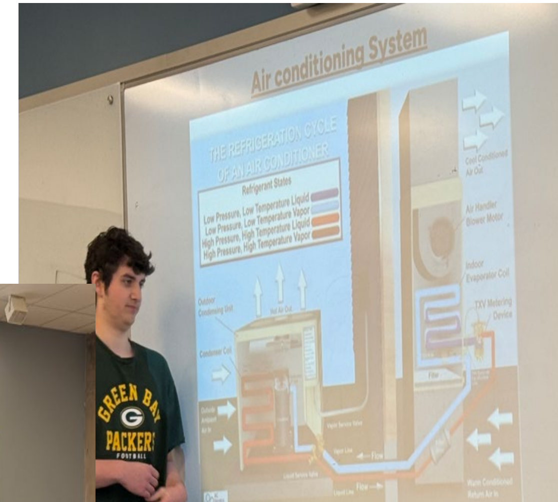
Accid -base equilibrium in enviromental science and agriculture

Reaction rate (Kinetics) in the field of Engineering

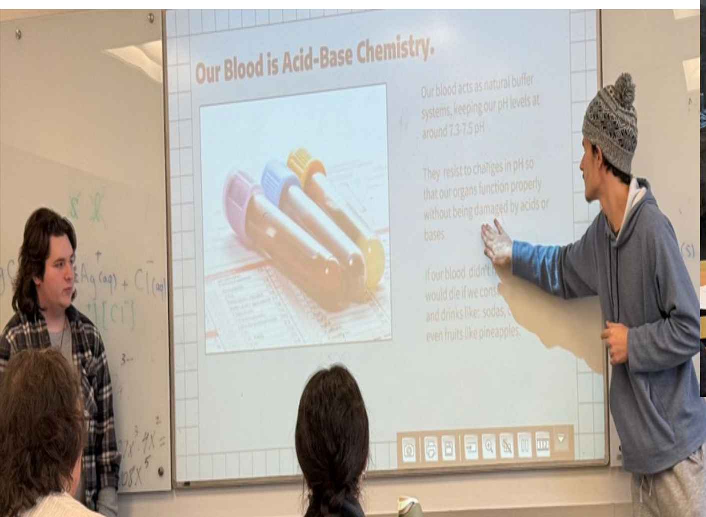
our blood in acid- base chemistry

Equilibrium and Phamaciutical (solubility of medicine)

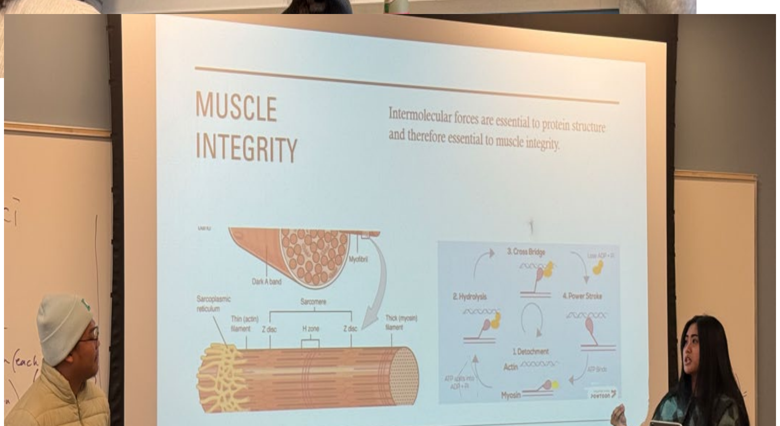

Engineering Application of Reaction Rates
Methane – Oxygen Combustion
Hydrogen – Oxygen Combustion

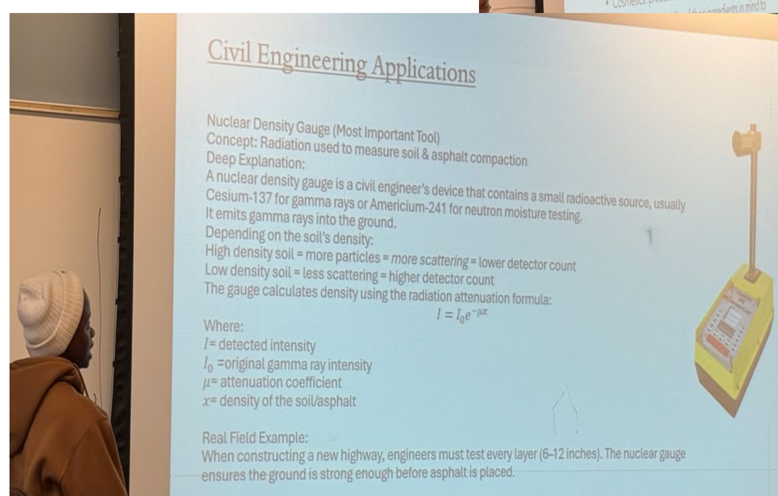

Air conditioning System
THE REFRIGERATION CYCLE OF AN AIR CONDITIONER
Refrigerant States
Low Pressure, Low Temperature Liquid
Low Pressure, Low Temperature Vapor
High Pressure, High Temperature Liquid
High Pressure, High Temperature Vapor


Potential Energy Drive the Muscle Contraction


Our Blood is Acid-Base Chemistry.
Our blood acts as natural buffer systems, keeping our pH levels at around 7.3-7.5 pH
They resist to changes in pH so that our organs function properly without being damaged by acids or bases


APPLICATION: PHARMACEUTICALS
The solubility of a medicine determines how well it is absorbed in the bloodstream for effective use. An understanding of solubility is helpful when designing certain drugs such as delayed-released medicines and injections, to know when and how the drug will dissolve in the body.


MUSCLE INTEGRITY
Intermolecular forces are essential to protein structure and therefore essential to muscle integrity.
Sarcomere
3. Cross Bridge
2. Hydrolysis
4. Power Stroke
1. Detachment
Actin
Myosin


Civil Engineering Applications
Nuclear Density Gauge (Most Important Tool)
Concept: Radiation used to measure soil & asphalt compaction
Deep Explanation:
A nuclear density gauge is a civil engineer's device that contains a small radioactive source, usually Cesium-137 for gamma rays or Americium-241 for neutron moisture testing.
It emits gamma rays into the ground.
Depending on the soil's density:
High density soil = more particles = more scattering = lower detector count
Low density soil = less scattering = higher detector count
The gauge calculates density using the radiation attenuation formula:
$I = I_0 e^{-\mu x}$
Where:
I= detected intensity
I_0 =original gamma ray intensity
μ= attenuation coefficient
x= density of the soil/asphalt
Real Field Example:
When constructing a new highway, engineers must test every layer (6–12 inches). The nuclear gauge ensures the ground is strong enough before asphalt is placed.

Project 2: Wrap-Up Exam Reflection & Improvement Plan

- Implemented after Exams 1, 2, and 3
- Each reflection worth 10 points
- Focused on exam performance analysis and improvement strategies
- Not implemented for Exam 4 due to timing at end of semester

Post-Exam 2 Reflection & Improvement Plan

Visible to students

Now that your exam grades are posted, take a few minutes to reflect and plan ahead! Think about what study habits helped you most, what topics were tricky, and what you can do differently next time. You'll review your missed questions, fix a few key ones, and set simple goals to boost your confidence for the final. This short reflection isn't about points—it's about learning from the process and finishing the semester stronger!

Post-Exam 3 Reflection & Improvement Plan

Review your Exam 3 and rewrite each incorrect question, marking your corrected answer in red or green in front of the question. For multiple-choice items, include a brief explanation of why you changed your answer. Take a clear photo of your corrected work and upload it to the assignment link on Blackboard.

Post-Exam 3 Reflection & Improvement Plan

Due date: 12/7/25, 11:59 PM (EST)

✓ Low-stakes structure supporting reflection, risk-taking, and growth mindset

Post-Exam#1_Reflection_Fall 2025

Post Exam #2_Reflection_Fall 2025.docx

Challenges **Project 1: Chemistry in Your Future Field (Group Presentation)**

- Introverted students were hesitant to participate in oral presentations
- Group collaboration required instructor facilitation (e.g., initiating email exchanges)
- Coordinating presentation logistics was challenging
- Limited in-class time due to extensive CHEM 132 content coverage (9 chapters)

Challenges – Project 2: Wrap-Up Exam Reflection & Improvement Plan

- Required substantial instructor time for review and individualized feedback
- Providing meaningful comments for each reflection increased grading workload

Student Feedback: Likert-Scale Results

- ✓ Reflection project improved awareness of learning strategies
- ✓ Students reported increased understanding of strengths and weaknesses
- ✓ Career connection project increased relevance and engagement
- ✓ Consistent positive trends across two course sections

Student Feedback: Open-Ended Responses

- I love to focus of chemistry in real world applications, and I love the emphasis on practice problems to be well prepared for the exams.

- I appreciated Professor Bandegi facilitating student success. She provided exam reflections which gave opportunity for learning and improvement. I also appreciated her flexibility and encouraging demeanor.

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Student Feedback: Open-Ended Responses Project #1

- **If you could change one thing about this assignment to improve learning, what would it be?**
- Honestly, I don't have a suggestion or comment about improving learning. I think the assignment was successful.
- I would say that the students could choose the chapter and partner. I personally enjoyed the chapter I covered and the partner I worked with, but I could imagine some students like having choice if they wanted to.
- Can you include an assignment on blackboard with a rubric for the slides, and if possible include the groups in that assignment. I noticed a lot of people in the class getting confused of who was in there group, sometimes mistaking me for being apart of their group.

- perhaps having the students make a kahoot of the key concepts of the chapter to increase engagement?
- Pair up with compatible partners. That way it would be more fun and proper utilization of time and energy.
- It felt like some of the presentations were overly focused on the chemistry topics rather than the real world connections. I think having an example of how the presentation is expected to be structured would be beneficial to future students
- Have the presentation dates a day or two after fully covering the chapter to be presented.

- **Any final comments or suggestions?**
- I thought the instruction, application, and timing of the assignment was well thought through and led to success.
- every one is not good at presenting .
- I enjoyed this presentation because it gave me the opportunity to learn more about a part of chemistry that is relevant to my field. I also appreciated working with my partner and learning from her research skills and abilities. I also liked how it engaged me in the topic of chemistry in a more creative way. For someone who is not strong in chemistry it gave me an opportunity to enjoy the topic without feeling burdened by quizzes, tests, or equations.
- I think its an interesting assignment that is worthwhile
- I would be cool if the power points were uploaded to the black board after they've all been presented. Some of the connections were pretty interesting and being able to revisit them would've been nice


THANK YOU

Back up slides

Assigned Chapter for Group Presentation	Name	Major
Chapter 14 Acid-Base Equilibria	Bobo, Bianca	Chemistry/Biology
	Bouley, Dennis	Biology
	Lopez, Theresa	Biology
Chapter 13 Fundamental Equilibrium Concepts	Dumayas, Austin	Biomedical engineering
	Tesfamichael, Medhane	Biochemistry
Chapter 21 Nuclear Chemistry	Kefela, Danayit	Chemistry
	Lopez, Giselle	Environmental Sciences
	Okunrinboye, Nifemi	Biomedical Engineering
Chapter 17 Electrochemistry	Matoka, Ilan Christopher	Computer Engineering
	Quiahuistle, Julio	Computer Science
	Ticona, Jhayzon	General Engineering
Chapter 16 Thermodynamics	Morat, Zime Anis Bylan	Aerospace Engineering (Drop)
	Nguyen, An	Biochemistry
	Patel, Puran	Mechanical Engineering
Chapter 15 Equilibria of Other Reaction Classes	Mutombo, Olive	Biological Sciences
	Pautrat, Miranda	Biology
	Pinnell, Isabel	Pre-Med
Chapter 12 Kinetics	Patamawenu, Amy	Biochem/Forensic
	Sandy, Grace	Biology
	Thomson Jacobs, Oliver	Bioengineering
Chapter 11 Solutions and Colloids	Vargas, JohnRhec	Biology
	Yanga, Francesca	Exercise Sciences