Ace Dr. Cook’s Chem 1201: Metacognition is the Key!

Saundra Y. McGuire, Ph.D.
Retired Asst Vice Chancellor & Professor of Chemistry
Director Emerita, Center for Academic Success
What’s your career track?

A. Education
B. Engineering
C. Science
D. Pre-Dent
E. Pre-Med
F. Pre-Nursing
G. Pre-Vet
H. Other Pre-Health
I. Other
LSU Center for Academic Success

National College Learning Center Association
Frank L. Christ Outstanding Learning Center Award
Presidential Award
White House Oval Office
November 16, 2007
**Sydnie’s Story: Intro and emails**

- First encounter on September 23, 2013
- Email on October 14, 2013
- Email on January 9, 2014
- Email on January 20, 2014
- Email on May 7, 2014
Sydnie’s Fall 2013 Test Grades

- Calculus
  64, 100, 97, 96, 90, 93 A in course

- Chemistry
  65, 95, 90, 70, 96 A in course
The Story of Four Other LSU General Chemistry Students

Robert
42, 100, 100, 100
Final Grade: A

Kristy
60, 100, 99, 84
Final Grade: A

Blanche
63, 79, 87, 100
Final Grade: A

Joshua
68, 50, (50), 87, 87, 97
Final Grade: A
What Made the Biggest Impact?

Getting the Most Out of Homework!

- Start the problems early—the day they are assigned
- **Do not flip back to see example problems; work them yourself!**
- Don’t give up too soon (<15 min.)
- Don’t spend too much time (>30 min.)
Why will this make the biggest impact for you?
Because you may have been starting the homework much too late!

142.5 on Test 1
157.5 on Test 1
Performance in Gen Chem I in 2011 Based on One Learning Strategies Session

<table>
<thead>
<tr>
<th></th>
<th>Attended</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1 Avg.:</td>
<td>71.65%</td>
<td>70.45%</td>
</tr>
<tr>
<td>Exam 2 Avg.:</td>
<td>77.18%</td>
<td>68.90%</td>
</tr>
<tr>
<td>Final course Avg*.:</td>
<td>81.60%</td>
<td>70.43%</td>
</tr>
</tbody>
</table>

**Final Course Grade:**  B  C

The one 50-min presentation on study and learning strategies again resulted in an improvement of one full letter grade!
Performance in Gen Chem 1202 Sp 2013
Based on One Learning Strategies Session

<table>
<thead>
<tr>
<th></th>
<th>Attended</th>
<th>Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1 Avg.:</td>
<td>71.33%</td>
<td>69.27%</td>
</tr>
<tr>
<td>Homework Total</td>
<td>169.8</td>
<td>119.1</td>
</tr>
<tr>
<td>Final course Avg*:</td>
<td>82.36%</td>
<td>67.71%</td>
</tr>
</tbody>
</table>

**Final Course Grade:**  B  D

The 50-min presentation on study and learning strategies resulted in an improvement of two letter grades!
Use Metacognition to Become an Expert Learner in Chemistry
Metacognition

The ability to:

- think about thinking
- be consciously aware of oneself as a problem solver
- monitor and control one’s mental processing (e.g. “Am I understanding this material?”)
- accurately judge one’s level of learning
Reflection Questions

What’s the difference, if any, between *studying* chemistry and *learning* chemistry?

For which task would you work harder:
A. Make an A on the test
B. Teach the material to the class?
Which mode have you been in?

A. Study Mode  
B. Learn Mode
For which task would you work harder?

A. Make an A on the Test
B. Teach the Material

80%

20%
Which mode were you in before Test 1?

A. Make an A on the Test
B. Teach the Material

88% 12%
To Ace Chem 1201 (and everything else!)

Stay in *learn* mode, not *study* mode

Study as if you have to *teach* the material, not just make an A on the test
Why is this so important?

Because 1201 is Harder Than HS Chem

- The course moves a lot faster
- The material is conceptually more difficult and cumulative
- The problems are more involved
- The tests are less straightforward and require you to apply several concepts at one time
Let’s Look at Some Challenging Problems from Test 1
A sodium chloride solution was prepared in a following manner:

- A 25.00 mL volumetric flask was placed on a balance and found to have a mass of 35.682 g.
- Sodium chloride was added to flask and the mass of the solid + flask was 36.232 g.
- The flask was filled to the mark of 25.00 mL with water and mixed well.

Calculate the density of the sodium chloride solution in units of g/mL and give the answer in scientific notation with the correct number of significant figures.

A) $2 \times 10^{-2}$ g/mL
B) $2.2 \times 10^{-2}$ g/mL
C) $2.20 \times 10^{-2}$ g/mL
D) $2.200 \times 10^{-2}$ g/mL
E) $2.2000 \times 10^{-2}$ g/mL
A sodium chloride solution was prepared in a following manner:

- A 25.00 mL volumetric flask was placed on a balance and found to have a mass of 35.682 g.
- Sodium chloride was added to flask and the mass of the solid + flask was 36.232 g.
- The flask was filled to the mark of 25.00 mL with water and mixed well.

Calculate the density of the sodium chloride solution in units of g/mL and give the answer in scientific notation with the correct number of significant figures.

A) $2 \times 10^{-2}$ g/mL
B) $2.2 \times 10^{-2}$ g/mL
C) $2.20 \times 10^{-2}$ g/mL
D) $2.200 \times 10^{-2}$ g/mL
E) $2.2000 \times 10^{-2}$ g/mL

27% B) $2.2 \times 10^{-2}$ g/mL $-35.682$
14.3% C) $2.20 \times 10^{-2}$ g/mL 0.550 3 decimal places
49.2% E) $2.2000 \times 10^{-2}$ g/mL 3 significant figures
What is the percent yield of CaO in the reaction \( \text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2 \) if 5.33 g of CaO are obtained when 10.0 g of CaCO$_3$ are used?

A) 5.60%
B) 53.3%
C) 64.7%
D) 5.33%
E) 95.1%
What is the percent yield of CaO in the reaction \( \text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2 \) if 5.33 g of CaO are obtained when 10.0 g of CaCO\(_3\) are used?

A) 5.60%

55.6% B) 53.3%

C) 64.7%

D) 5.33%

30.2 % E) 95.1%

\[
\text{% yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%
\]

\text{actual yield} = 5.33 \text{ g CaO}

\text{but}

\text{theoretical yield of CaO must be calculated (stoichiometry problem) and then used.}

Note: 10.0 g of CaCO\(_3\) is NOT it!
Effective test taking strategies

- Survey the test and start with the easy questions (ALL questions are worth 7.5 points, regardless of time required or difficulty level.)
- Budget your time per question; move on to the next one if you’re getting bogged down
- If something looks like a mistake, note it and say something about it to Dr. Cook
Metacognition

The ability to:

- think about thinking
- be consciously aware of oneself as a problem solver
- monitor and control one’s mental processing (e.g. “Am I understanding this material?”)
- accurately judge one’s level of learning
Bloom’s Taxonomy

- **Remembering**: Retrieving, recognizing, and recalling relevant knowledge from long-term memory.
- **Understanding**: Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.
- **Applying**: Carrying out or using a procedure through executing, or implementing.
- **Analyzing**: Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure.
- **Evaluating**: Making judgments based on criteria and standards through checking and critiquing.
- **Creating**: Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

This pyramid depicts the different levels of thinking we use when learning. Notice how each level builds on the foundation that precedes it. It is required that we learn the lower levels before we can effectively use the skills above.

[http://www.odu.edu/educ/lkschult/blooms_taxonomy.htm](http://www.odu.edu/educ/lkschult/blooms_taxonomy.htm)
At what level of Bloom’s did you have to operate to make A’s and B’s in high school?

A. Remembering
B. Understanding
C. Applying
D. Analyzing
E. Creating
F. Evaluating
At what level of Bloom’s do you think you’ll have to operate to make A’s in Chem 1201?

A. Remembering
B. Understanding
C. Applying
D. Analyzing
E. Creating
F. Evaluating
How do you move yourself higher on Bloom’s Taxonomy?

Use the **Study Cycle** with **Intense Study Sessions**!
The Study Cycle

**Preview**  
- *Preview before class* – Skim the chapter, note headings and boldface words, review summaries and chapter objectives, and come up with questions you’d like the lecture to answer for you.

**Attend**  
- *Attend class* – GO TO CLASS! Answer and ask questions and take meaningful notes.

**Review**  
- *Review after class* – As soon after class as possible, read notes, fill in gaps and note any questions.

**Study**  
- *Study* – Repetition is the key. Ask questions such as ‘why’, ‘how’, and ‘what if’.
  - Intense Study Sessions* – 3-5 short study sessions per day
  - Weekend Review – Read notes and material from the week to make connections

**Assess**  
- *Assess your Learning* – Periodically perform reality checks
  - Am I using study methods that are effective?
  - Do I understand the material enough to teach it to others?

*Intense Study Sessions*

1. **Set a Goal**  
   - (1-2 min)  
   - Decide what you want to accomplish in your study session

2. **Study with Focus**  
   - (30-50 min)  
   - Interact with material - organize, concept map, summarize, process, re-read, fill-in notes, reflect, etc.

3. **Reward Yourself**  
   - (10-15 min)  
   - Take a break – call a friend, play a short game, get a snack

4. **Review**  
   - (5 min)  
   - Go over what you just studied

---

Center for Academic Success  
B-31 Coates Hall • 225.578.2872 • www.cas.lsu.edu
**Effective Metacognitive Strategies**

- Always solve problems without looking at an example or the solution
- Memorize everything you’re told to memorize (e.g. polyatomic ions)
- Always ask why, how, and what if questions
- Test understanding by giving “mini lectures” on concepts
- Spend time on chemistry every day
- Use the Study Cycle with Intense Study Sessions
- Attend SI sessions on a regular basis
- Aim for 100% mastery, not 90%!
A Reading Strategy that Works: SQ5R

- **Survey** (look at intro, summary, bold print, italicized words, etc.)
- **Question** (devise questions survey that you think the reading will answer)
- **Read** (one paragraph at a time)
- **Recite** (summarize in your own words)
- **Record or Write** (annotate in margins)
- **Review** (summarize the information in your words)
- **Reflect** (other views, remaining questions)
An Effective Homework Strategy

- Study information before looking at the problems/questions
- Work example problems (without looking at the solutions) until you get to the answer
- Check to see if answer is correct
- If answer is not correct, figure out where mistake was made, without consulting solution
- Work homework problems/answer questions as if taking a test
Which One of the Next Two Slides More Accurately Describes YOUR Actions Before Test 1?
Top 5 Reasons Folks Did Not Do Well on Test 1 in Gen Chemistry:

1. Didn’t spend enough time on the material
2. Started the homework too late
3. Didn’t memorize the information I needed to
4. Did not use the book
5. Assumed I understood information that I had read and re-read, but had not applied
Top 5 Reasons Folks Made an A on Test 1:

1. Did preview-review for every class
2. Did a little of the homework at a time
3. Used the book and did the suggested problems
4. Made flashcards of the information to be memorized
5. Practiced explaining the information to others
Which group did you most resemble?

A. Group that did not do well
B. Group that made an A
At the end of the presentation, they were given a survey to determine their self-assessment of their use of the strategies, and were divided into groups:

**Group 1:** students who did not use the strategies  
**Group 2:** students who used the strategies

The results are shown below:

<table>
<thead>
<tr>
<th>Use of Strategies</th>
<th>Av. on Exams 1 and 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students who did not use the strategies</td>
<td>58 and 54</td>
</tr>
<tr>
<td>Students who used the metacognitive learning strategies</td>
<td>95 and 80</td>
</tr>
</tbody>
</table>

*Using the strategies makes the difference!*
So, What Can You Do, Starting Now, to Pursue Your 4.0 this fall?

- Spend more time studying (at least 2 hours/week for every hour in class)
- Aim for higher learning levels and 100% understanding
- Use office hours and study groups productively
- Use the Study Cycle with Intense Study Sessions
- Use Metacognition to Study Smarter!!!
Get the Most Out of Homework
Reprise

- Start the problems early--the day they are assigned
- **Do not flip back to see example problems; work them yourself!**
- Don’t give up too soon (<15 min.)
- Don’t spend too much time (>30 min.)
Get the Most from SI Sessions, Tutorial Centers, Office Hours, and Study Groups

- Try to understand the concept or work the problem by yourself first
- Come prepared to ask questions
- Explain the material to the tutor or instructor
Challenge to Dr. Cook’s students

Metacognition Discussion – Sep 25, 2015

Average on Exam 2: 120 (80%)

How do I know you CAN do this?

Because students at New Mexico State University did it!
Writing Exercise

What strategy will you use for the next three weeks?
Which one strategy are you most likely to implement for the next test?

A. Do preview review
B. Do homework differently
C. Use the textbook more
D. Do more problems
E. Practice teaching the material
F. None of the above

![Bar chart showing the percentage for each strategy:]
- Do preview review: 33%
- Do homework differently: 12%
- Use the textbook more: 16%
- Do more problems: 11%
- Practice teaching the material: 26%
- None of the above: 2%
If you don’t try it in within the next 48 hours...

... you probably never will.
Final Note

Please visit our website at www.cas.lsu.edu.
We have on-line workshops and information that will teach you even more effective study strategies. We wish you a fantastically successful future!

The Center for Academic Success
B-31 Coates Hall
www.cas.lsu.edu