Teach Students *How* to Learn: A Small Change that Can Make A Big Impact!

It's the little details that are vital. Little things make big things happen.

John Wooden

Saundra Yancy McGuire, Ph.D.
Retired Asst. Vice Chancellor & Professor of Chemistry
Director Emerita, Center for Academic Success
Louisiana State University
10th Annual Conference Theme:
“Small Changes, Big Impact: 10 Years of ITL”
George Mason University
Retention and Graduation Rates

GMU Retention Rate is 87.0%!
National Average is 72.0%
Virginia Average is 71.0%

GMU Six-Year Graduation Rate is 69.4%
National Average is 47.6%

Expected GMU Grad Rate is 70.4%

How Can GMU Improve These Rates?

- Teach Students Metacognitive Learning Strategies
- Help Students Develop the Right Mindset
- Motivate Students to Implement Effective Metacognitive Learning Strategies
Metacognition: The Key to Teaching Students How to Learn

The ability to:

- think about your own thinking
- be consciously aware of yourself as a problem solver
- monitor, plan, and control your mental processing (e.g. “Am I understanding this material, or just memorizing it?”)
- accurately judge your level of learning
- know what you know and what you don’t know

Why haven’t many students *already* developed these skills?

*It wasn’t necessary*
Data from UCLA Higher Education Research Institute (HERI)  
First Year Student Survey – 2010 - 2016

<table>
<thead>
<tr>
<th>% who spent at least 6 hrs/wk on homework</th>
<th>% who graduated with an A average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>37.3</td>
</tr>
<tr>
<td>2011</td>
<td>39.5</td>
</tr>
<tr>
<td>2012</td>
<td>38.4</td>
</tr>
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<td>2013</td>
<td>41.4</td>
</tr>
<tr>
<td>2014</td>
<td>42.9</td>
</tr>
<tr>
<td>2015</td>
<td>44.8</td>
</tr>
<tr>
<td>2016</td>
<td>44.0</td>
</tr>
</tbody>
</table>

HERI DATA  
2010 - 2016

http://www.heri.ucla.edu
How do you think most students would answer the following?

- What did most of your teachers in high school do the day before the test?
- What did they do during this activity?
- What grade would you have made on the test if you had gone to class only on the day before the test?
Faculty Must Help Students Make the Transition to College

Help students identify and close “the gap”

current behavior $\rightarrow$ current grades

MIND THE GAP

productive behavior $\rightarrow$ desired grades
Power of Metacognitive Learning Strategies
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
- Update on July 26, 2016  Cum GPA 3.5
- Email on February 7, 2017  Cum GPA 3.6

Fall Sem GPA 4.18
Sydnie Landry, BS in Biology, May 2017
Louisiana State University
Final Semester GPA: 3.77

Currently Applying to Medical School
Intended Specialty: Dermatology
Teaching an Effective Homework Strategy
A Small Change that Makes a Big Impact

• **Study material first**, 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
I started to use the "Get more out of your homework" method. I reviewed my notes right before attempting my homework problems, and tried to work the problems without help from the solutions manual or tutors. If I still could not get the right answer, I'd look at my notes again to get a hint, but not to study the problem and mimic it step by step...
Asking Reflection Questions
A Small Change that Makes a Big Impact

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

• For which task would you work harder?
  A. Make an A on the test
  B. Teach the material to the class
Power of Teaching to Master Learning
Clint’s Story: Baby Groot and the Licensure Exam

Guardians of the Galaxy

- First encounter on October 29, 2015 at EKU
- Email on January 18, 2016
- Msg on April 14, 2016
- Msg on June 11, 2016

https://www.youtube.com/watch?v=BEPbXYzE5_Y
The Story of Two Students

- **Travis**, junior psychology student
  - 47, 52, **82, 86** B in course

- **Dana**, first year physics student
  - 80, 54, **91, 97, 90 (final)** A in course
Travis, *junior psychology student*

47, 52, **82, 86**

**Problem:** Reading Comprehension

**Solution:** Preview text before reading*

Develop questions*

Read one paragraph at a time and paraphrase information

* Developing an anticipatory set
Teaching the SQ5R Reading Strategy
A Small Change that Makes a Big Impact

- **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)
WITH HOCKED GEMS FINANCING HIM/ OUR HERO BRAVELY DEFIED ALL SCORNFUL LAUGHTER/ THAT TRIED TO PREVENT HIS SCHEME/ YOUR EYES DECEIVE/ HE HAD SAID/ AN EGG/ NOT A TABLE/ CORRECTLY TYPIFIES THIS UNEXPLORED PLANET/ NOW THREE STURDY SISTERS SOUGHT PROOF/ FORGING ALONG SOMETIMES THROUGH CALM VASTNESS/ YET MORE OFTEN OVER TURBULENT PEAKS AND VALLEYS/ DAYS BECAME WEEKS/ AS MANY DOUBTERS SPREAD FEARFUL RUMORS ABOUT THE EDGE/ AT LAST/ FROM NOWHERE/ WELCOME WINGED CREATURES APPEARED/ SIGNIFYING MOMENTOUS SUCCESS

Dana, *first year physics student*

80, 54, **91, 97, 90 (final)**

**Problem:** Memorizing formulas and using www.cramster.com

**Solution:** Solve problems with no external aids and test mastery of concepts
Dana Lewis, MS in Medical Physics, 2015
Univ of Texas Graduate School
of Biomedical Sciences at Houston
Thesis research at UT MD Anderson Cancer Center

Practicing Medical Physicist as of 8/28/2016
when she completed her residency!
Why is Fast and Dramatic Increase Possible?

It’s all about the strategies, and getting them to engage their brains!
Counting Vowels in 45 seconds

How accurate are you?

Count all the vowels in the words on the next slide.
<table>
<thead>
<tr>
<th>Dollar Bill</th>
<th>Cat Lives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dice</td>
<td>Bowling Pins</td>
</tr>
<tr>
<td>Tricycle</td>
<td>Football Team</td>
</tr>
<tr>
<td>Four-leaf Clover</td>
<td>Dozen Eggs</td>
</tr>
<tr>
<td>Hand</td>
<td>Unlucky Friday</td>
</tr>
<tr>
<td>Six-Pack</td>
<td>Valentine’s Day</td>
</tr>
<tr>
<td>Seven-Up</td>
<td>Quarter Hour</td>
</tr>
<tr>
<td>Octopus</td>
<td></td>
</tr>
</tbody>
</table>
How many *words* or *phrases* do you remember?
Let’s look at the words again...

What are they arranged according to?
Dollar Bill  Cat Lives
Dice          Bowling Pins
Tricycle      Football Team
Four-leaf Clover Dozen Eggs
Hand          Unlucky Friday
Six-Pack      Valentine’s Day
Seven-Up      Quarter Hour
Octopus
NOW, how many words or phrases do you remember?
What were two major differences between the two attempts?

1. We knew what the task was

2. We knew how the information was organized
Two Small Changes That Make a Big Impact

1. Make Sure Students Know the Goal

2. Help Students Discover the Structure
What we know about learning

• Active learning is more lasting than passive learning
  -- Passive learning is an oxymoron*

• Thinking about thinking is important
  – Metacognition**

• The level at which learning occurs is important
  – Bloom’s Taxonomy***


Creating

Evaluating

Analyzing

Applying

Understanding

Remembering

Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure.

Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.

Making judgments based on criteria and standards through checking and critiquing.

Carrying out or using a procedure through executing, or implementing.

Retrieving, recognizing, and recalling relevant knowledge from long-term memory.

http://www.odu.edu/educ/llschult/blooms_taxonomy.htm
When we teach students about Bloom’s Taxonomy...

They GET it!
How do you think students answered?

At what level of Bloom’s did you have to operate to make A’s or B’s in high school?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating
How do you think students answered?

At what level of Bloom’s do you think you’ll need to operate to make A’s in college courses?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating
How students answered (2008)

At what level of Bloom’s did you have to operate to make A’s or B’s in high school?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating
At what level of Bloom’s do you think you’ll need to operate to make an A’s in college?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating
At what level of Bloom’s did you have to operate to make A’s or B’s in high school?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating

How students answered (2013)
How students answered (in 2013)

At what level of Bloom’s do you think you’ll need to operate to make A’s in college?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating
At what level of Bloom’s did you have to operate to make A’s and B’s in high school?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating

How students answered (2014)
At what level of Bloom’s do you think you’ll need to operate to make A’s in college?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating

How students answered (in 2014)
At what level of Bloom’s did you have to operate to make A’s and B’s in high school?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating

How students answered (2017)
At what level of Bloom’s do you think you’ll need to operate to make A’s in college?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating

How students answered (in 2017)
At what level of Bloom’s do you think you’ll need to operate to make A’s and B’s in high school?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating

How students answered (in 2018)
At what level of Bloom’s do you think you’ll need to operate to make A’s in college?

1. Remembering
2. Understanding
3. Applying
4. Analyzing
5. Evaluating
6. Creating

How students answered (in 2018)
How do we teach students to move *higher* on Bloom’s Taxonomy?

Teach them the Study Cycle*
A Small Change That Makes a HUGE Impact

*adapted from Frank Christ’s PLRS system
The Study Cycle

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

*Intense Study Sessions*

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**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 class** — GO TO CLASS! Answer and ask questions and take meaningful notes.

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

**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 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?

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Center for Academic Success
B-31 Coates Hall • 225.578.2872 • www.cas.lsu.edu
Brea Manuel, BS in Chemistry, 2018
Entered PhD Program at Emory University on Full Fellowship in Fall 2018

The intense study sessions helped me most. I actually got A+ on 3 out of 4 of my finals using that method of studying. It’s important to use it everyday before finals week, and I think it would really benefit students during finals week.
What happens when we teach metacognitive learning strategies, Bloom’s Taxonomy, and the Study Cycle to an entire class, not just individuals?
The one 50-min presentation on study and learning strategies was followed by an improvement of one full letter grade.

A Small Change that Made a Big Impact

Performance in Gen Chem 1202 Sp 2013
Based on One Learning Strategies Session

<table>
<thead>
<tr>
<th></th>
<th>Attended</th>
<th>Absent</th>
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<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>
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<tr>
<td>Final course Avg*:</td>
<td>82.36%</td>
<td>67.71%</td>
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<tr>
<td>Final Course Grade:</td>
<td>B</td>
<td>D</td>
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</table>

The 50-min presentation on study and learning strategies was followed by an improvement of two letter grades.
### Performance in Gen Chem 1202 Sp 2015 Based on One Learning Strategies Session

<table>
<thead>
<tr>
<th></th>
<th>Attended</th>
<th>Absent</th>
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<tr>
<td>Exam 1, 2, 3 Avg:</td>
<td>68.14%</td>
<td>69.67%</td>
</tr>
<tr>
<td>Exam 4 Avg:</td>
<td>83.45%</td>
<td>75.91%</td>
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<tr>
<td>Final Exam Avg:</td>
<td>80.98%</td>
<td>75.24%</td>
</tr>
<tr>
<td>Final course Avg*:</td>
<td>84.90%</td>
<td>78.83%</td>
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</table>

**Final Course Grade:** B C

The 50-min presentation on study and learning strategies *after exam 3* was followed by an improvement of one letter grade.
Metacognition: An Effective Tool to Promote Success in College Science Learning*

Ningfeng Zhao¹, Jeffrey Wardeska¹, Saundra McGuire², Elzbieta Cook²

¹Department of Chemistry, East Tennessee State University
²Department of Chemistry, Louisiana State University

*March/April 2014 issue of JCST, Vol. 43, No. 4, pages 48-54
From failure to success in general chemistry: Learning strategies to the rescue

Dr. Elzbieta Cook and Saundra Y. McGuire

INTRODUCTION
This project targeted students who performed poorly on General Chemistry Exam 1 but managed to dramatically improve their scores on Exam 2. A new campus-wide orientation to learning strategies, presented by Dr. Cook shortly after the mid-term, improved results of Exam 1. Student datasets taught by Cook, familiar to the most effective. We also wanted to find out which strategies students tried and did not feel successful. Recommendations were simply "based on interest," whether the timing of the intervention could have been better, and whether the students continued to benefit from the learning strategies on the subsequent test.

METHOD
A total of 397 students completed Cook's General Chemistry I class in Fall 2010 and 118 in the regular class (CHEM 1201) and 130 in the honors General Chemistry course (CHEM 1201H). The criteria for the invitation to participate in a focus group (FG) were: (1) low score (< 60%) on Exam 1, (2) at least 2 lower grades on Exam 2.

Forty one out of 118 CHEM 1201 and 37 out of 118 CHEM 1201H students were invited to participate in FGs. Students individually agreed to participate, of whom 12 (25%) of participants did participate. All FGs successfully completed presented (14 participants).

Three FGs were scheduled to accommodate the schedules of all participants. Interviews were conducted by an independent moderator. To preserve the anonymity of interviews, students were referred to as x1, x2, etc. For example, FG13 refers to student 1 who participated in the first focus group.

RESULTS AND DISCUSSION

Dr. Elzbieta Cook
My General Chemistry Collaborator
Professor Ningfeng Zhao’s Exam Averages

![Graph showing exam averages for different fall seasons]

Intervention:
One fifty minute learning strategies session after Exam 1

## Professor Nina Stein’s Exam Averages in Organic Chemistry

<table>
<thead>
<tr>
<th>EXAM</th>
<th>AVERAGE</th>
<th>AVERAGE</th>
<th>AVERAGE*</th>
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<tbody>
<tr>
<td></td>
<td>Fall 2012</td>
<td>Fall 2013</td>
<td>Fall 2014</td>
</tr>
<tr>
<td>1</td>
<td>69.25</td>
<td>70.06</td>
<td>77.42</td>
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<tr>
<td>2</td>
<td>79.40</td>
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<td>86.17</td>
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<td>3</td>
<td>70.35</td>
<td>73.38</td>
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<tr>
<td>final</td>
<td>66.00</td>
<td>63.06</td>
<td>82.17</td>
</tr>
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</table>

*The semester I did the study skills workshop

Intervention: One twenty minute learning strategies session after Exam 1

Nina Stein, University of Connecticut, personal communication, April 4, 2015
Three Common Demands from Students in Large Lecture Classes*

- **Provide Presentation Slides Before Lecture**
  - *Helps with notetaking and cuing prior knowledge*

- **Make Practice Tests Available**
  - *Helps students “train their brains to make the kinds of mental maneuvers we expect of them*
  - *Helps with notetaking and cuing prior knowledge*
  - *Having them write a question engages them in higher order thinking and promotes their metacognitive abilities*

- **Implement More Active Learning or More Teaching**
  - *Research supports the value of active learning, but some students don’t like it. Explaining its value helps.*

Hodges, Linda C, *National Teaching and Learning Forum*, Volume 25, Number 5, September 2016, as reprinted in February 26, 2017 “Tomorrow’s Professor℠ eNewsletter, sponsored by the Stanford Center for Teaching and Learning and provided by Rick Reis.
Email from a Professor Who Made Small Changes

After the ND-Gateway workshop this August, I have shared Dr. McGuire’s presentation with several of my colleagues and students in the ABEN department.

One ABEN student was struggling on his classes. I asked how he studied, and found he didn’t have a good study habit. I shared the PPT with him on August 21, 2018, and also emphasized the contents in slide 32 (Bloom’s Taxonomy) and slide 45 (Study Cycle). He wrote me an email today (September 7, 2018) and said:

“I actually am applying myself and changed my study and planning habits and it seems to be paying off already. I scored 114% on the first and only graded homework assignment so far and took the first exam on Wednesday and got 100%.”

I also applied the suggestion in Slide 14 to my class, and invited students to co-teach some lectures with me. They did a fantastic job by adding much more contents and real world experience to the class. This is truly a wonderful experience for me because I saw students poured their passion and talent into the lecture.

Please extend my appreciation to Dr. McGuire.

Thanks,

Xinhua Jia, Ph.D., P.E.
Associate Professor
Office: Morrill Hall 204
Dept. of Agricultural and Biosystems Engineering
North Dakota State University
## LSU Analytical Chemistry Graduate Student’s Cumulative Exam Record

<table>
<thead>
<tr>
<th>Date</th>
<th>Result</th>
<th>Notes</th>
</tr>
</thead>
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<tr>
<td>9/04</td>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td>10/04</td>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td>11/04</td>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td>12/04</td>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td>1/05</td>
<td>Passed</td>
<td>Began work with CAS and the Writing Center in October 2005</td>
</tr>
<tr>
<td>2/05</td>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td>3/05</td>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td>4/05</td>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td>10/05</td>
<td>Passed</td>
<td></td>
</tr>
<tr>
<td>11/05</td>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td>12/05</td>
<td>Passed best in group</td>
<td></td>
</tr>
<tr>
<td>1/06</td>
<td>Passed</td>
<td></td>
</tr>
<tr>
<td>2/06</td>
<td>Passed</td>
<td></td>
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<tr>
<td>3/06</td>
<td>Failed</td>
<td></td>
</tr>
<tr>
<td>4/06</td>
<td>Passed last one!</td>
<td></td>
</tr>
<tr>
<td>5/06</td>
<td>N/A</td>
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</tr>
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</table>
Dr. Algernon Kelley, December 2009
Oct. 17, 2011
Hello Dr. Kelley. ... I am struggling at Xavier and I REALLY want to succeed, but everything I've tried seems to end with a "decent" grade. I’m not the type of person that settles for decent. What you preached during the time you were in Dr. Privett's class last week is still ringing in my head. I really want to know how you were able to do really well even despite your circumstances growing up. I was hoping you could mentor me and guide me down the path that will help me realize my true potential while here at Xavier. Honestly I want to do what you did, but I seriously can't find a way how to. Can I please set up a meeting with you as soon as you’re available so I can learn how to get a handle grades and classes?

Oct. 24, 2011
Hey Dr. Kelley, I made an 84 on my chemistry exam (compared to the 56 on my first one) using your method for 2 days (without prior intense studying). Thanks for pointing me in the right direction. I’ll come by your office Friday and talk to you about the test.

Nov 3, 2011
Hey Dr. Kelley! I have increased my Bio exam grade from a 76% to a 91.5% using your system. Ever since I started your study cycle program, my grades have significantly improved. I have honestly gained a sense of hope and confidence here at Xavier. My family and I are really grateful that you have taken time to get me back on track.
Conclusion

We can significantly impact student learning by making small changes

• teach students how to learn
• make learning visible
• Can’t judge student potential on initial performance
• encourage students to persist in the face of initial failure
• Encourage the use of metacognitive tools for deep and integrative learning
Final Reflection Questions

Who is *primarily* responsible for student learning?

a) the student
b) the instructor
c) the institution
Who do you think *students* say is *primarily* responsible for student learning?

a) the student
b) the instructor
c) the institution
The reality is that...

when *all three* of these entities take *full responsibility* for student learning, we will experience an *increase* in academic capability, confidence, retention, and graduation rates!
Useful Websites

- www.lsu.edu/students/cas/
- www.howtostudy.org
- www.vark-learn.com
- www.drealbloom.com
Acknowledgements

- Colleagues at LSU, especially the Center for Academic Success and the Department of Chemistry
- Dr. Elzbieta Cook
- Sarah Baird, former CAS learning strategist
- National College Learning Center Association (NCLCA)
- The many students who have proven to us that metacognitive strategies really do work!
References


  
  http://academic.pg.cc.md.us/~wpeirce/MCCCTR/metacognition.htm
  
  *Excellent student reference*