Metacognition, Mindset and Motivation: Keys to Improving Student Learning!

Saundra Y. McGuire, Ph.D.
(Ret) Assistant Vice Chancellor and Professor of Chemistry
Director Emerita, Center for Academic Success
AAAS, ACS, CLADEA Fellow
Metacognition

The ability to:

- think about your own thinking
- be consciously aware of your 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 most students developed these skills?

It wasn’t necessary in high school
Data from UCLA Higher Education Research Institute (HERI First Year Student Survey – 2010 - 2015

<table>
<thead>
<tr>
<th>Year</th>
<th>% who spent &lt; 6 hrs/wk on homework</th>
<th>% who graduated with an A average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>62.7</td>
<td>48.4</td>
</tr>
<tr>
<td>2011</td>
<td>60.5</td>
<td>49.7</td>
</tr>
<tr>
<td>2012</td>
<td>61.6</td>
<td>49.5</td>
</tr>
<tr>
<td>2013</td>
<td>58.6</td>
<td>52.8</td>
</tr>
<tr>
<td>2014</td>
<td>57.1</td>
<td>53.1</td>
</tr>
<tr>
<td>2015</td>
<td>55.2</td>
<td>58.7</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

The College Board’s 2013 SAT® Report on College & Career Readiness reveals that fewer than half of all SAT takers in the class of 2013 graduated from high school academically prepared for the rigors of college-level coursework. This number has remained virtually unchanged during the last five years, underscoring a need to dramatically increase
ACT Alarmed by U.S. Student Test Results

By Dian Schaffhauser | 08/26/15

This year’s ACT results show 31 percent of students still unready for college in English, math, reading or science — every subject tested by the assessment organization. That’s a figure that has not changed since 2012, when it was slightly higher. Fewer than a fifth of those students can be expected to go on to earn a college degree within six years.
Faculty AND Academic Staff Must Help Students Make the Transition to College

Help students identify and close “the gap”

- current behavior → current grades
- productive behavior → 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
Reflection Questions

• 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
To Ace Courses (and everything else!) Students Must:

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

• Study as if they have to *teach* the material, not just make an A on the test
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
- Email on January 18, 2016
- Msg on April 14, 2016
- Msg on June 11, 2016

https://www.youtube.com/watch?v=BEPbXYzE5_Y
Help Students Develop the Right Mindset


Mindset* is Important!

- **Fixed Intelligence Mindset**
  Intelligence is static
  You have a certain amount of it

- **Growth Intelligence Mindset**
  Intelligence can be developed
  You can grow it with actions

New York: Random House Publishing
Responses to *Many* Situations are Based on Mindset

<table>
<thead>
<tr>
<th></th>
<th>Fixed Intelligence Mindset Response</th>
<th>Growth Intelligence Mindset Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Challenges</td>
<td>Avoid</td>
<td>Embrace</td>
</tr>
<tr>
<td>Obstacles</td>
<td>Give up easily</td>
<td>Persist</td>
</tr>
<tr>
<td>Tasks requiring effort</td>
<td>Fruitless to Try</td>
<td>Path to mastery</td>
</tr>
<tr>
<td>Criticism</td>
<td>Ignore it</td>
<td>Learn from it</td>
</tr>
<tr>
<td>Success of Others</td>
<td>Threatening</td>
<td>Inspirational</td>
</tr>
</tbody>
</table>
Which mindset about intelligence do you think *most students* have?

1. Fixed
2. Growth
Which mindset about intelligence do you think *most faculty* have?

1. Fixed
2. Growth
Which mindset about intelligence do you think *most STEM faculty* have?

1. Fixed
2. Growth
“...Personally, I am not so good at chemistry and unfortunately, at this point my grade for that class is reflecting exactly that. I am emailing you inquiring about a possibility of you tutoring me.”

April 6, 2011

“I made a 68, 50, (50), 87, 87, and a 97 on my final. I ended up earning a 90 (A) in the course, but I started with a 60 (D). I think what I did different was make sidenotes in each chapter and as I progressed onto the next chapter I was able to refer to these notes. I would say that in chemistry everything builds from the previous topic.

May 13, 2011

Semester GPA: 3.8
Motivation

“Motivation refers to the personal investment an individual has in reaching a desired state or outcome.”

(Ambrose et. al, 68)

“In the academy, the term ‘motivating’ means stimulating interest in a subject and, therefore, the desire to learn it.”

(Nilson, 57)
Three Important Levers that Influence Motivation

- **Value** – the importance of a goal (attainment, intrinsic, instrumental)

- **Supportive Nature of the Environment** – the instructor is approachable, support is available from peers and others

- **Efficacy Expectancies** – the belief that one is capable of identifying, organizing, initiating, and executing a course of action that will bring about a desired outcome

Ambrose et al., 80
Ways to Create A Supportive Environment

• Introduce engaging, fun activity if possible
• Show your human side – hobbies, past academic struggles, etc.
• Emphasize the importance of effort, rather than prior experiences, in performance
• Demonstrate confidence that every student *can* succeed!
Learned Helplessness*

Based on prior experience, the feeling that no amount of effort will bring success destroys motivation to attempt a task.

*Martin Seligman and Steven F. Maier

Sometimes the chains that prevent us from being free are more mental than physical.
Solving Anagrams

http://www.youtube.com/watch?v=MTqBP-x3yR0
Five Bases of Intrinsic Motivation

- Autonomy (Control One’s Own Destiny)
- Competence (Do Things that Help One Feel Successful)
- Belonging (To Feel Part of a Group Effort)
- Self-Esteem (To Feel Good About Who They Are)
- Involvement and Enjoyment (To Find Pleasure in What They Do)

James Raffini, Allyn and Bacon, 1995
Sharing Strategies that Have Worked for Others Can Be Very Motivational
Top 5 Reasons Students Made an F on Test 1 in General 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 memorize
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
What happens when we **teach** metacognitive learning strategies, Bloom’s Taxonomy, and the Study Cycle **to an entire class**, not just individuals?
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>
<tr>
<td>Final Course Grade:</td>
<td><strong>B</strong></td>
<td><strong>C</strong></td>
</tr>
</tbody>
</table>

The one 50-min presentation on study and learning strategies was followed by 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 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>
</tr>
</thead>
<tbody>
<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>
</tr>
<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>
</tr>
<tr>
<td><strong>Final Course Grade:</strong></td>
<td><strong>B</strong></td>
<td><strong>C</strong></td>
</tr>
</tbody>
</table>

The 50-min presentation on study and learning strategies after exam 3 was followed by an improvement of one letter grade.
At the end of a 60 minute learning strategies presentation by the professor, students were given a survey to determine their self-assessment of whether they were using or not using the strategies. The average scores of the different groups on the first two exams are shown below.

<table>
<thead>
<tr>
<th>Self-Reported Use of Strategies</th>
<th>Exam 1</th>
<th>Exam 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not use the strategies</td>
<td>58</td>
<td>54</td>
</tr>
<tr>
<td>Used metacognitive strategies</td>
<td>95</td>
<td>80</td>
</tr>
</tbody>
</table>
Comments from Engineering Students about what they changed for Test 3*

- I changed my study habits by **doing the homework early**. I also **started reading some of the material before going to the class**. The most effective was **spending more time on the material**.

- I **started studying for the exam sooner**. I also took more time to do the homework. I **reviewed/rewrote my notes from class**.

- I **studied for the class as close to everyday** as possible

- I **got together with other classmates** and helped them with their weakness and of course they helped me with mine as well.

*class average increased from 65.7% to 80.5%!

*(for students who took all three course exams)*
Before and After

- Robert, freshman chemistry student
  42, 100, 100, 100  A in course
- Michael, senior pre-med organic student
  30, 28, 80, 91  B in course
- Miriam, freshman calculus student
  37.5, 83, 93  B in course
- Ifeanyi, sophomore thermodynamics student
  67, 54, 68, 95  B in course
- Terrence, junior Bio Engineering student
  GPA 1.67 cum, 3.54 (F 03), 3.8 (S 04)
# Chemistry 2001

<table>
<thead>
<tr>
<th></th>
<th>Class Average</th>
<th>Student 1</th>
<th>Student 2</th>
<th>Student 3</th>
<th>Student 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test 1</strong></td>
<td>76</td>
<td>65</td>
<td>67</td>
<td>70</td>
<td>83</td>
</tr>
<tr>
<td><strong>Test 2</strong></td>
<td>52</td>
<td>67</td>
<td>65</td>
<td>46</td>
<td>55</td>
</tr>
<tr>
<td><strong>Test 3</strong></td>
<td>72</td>
<td>61</td>
<td>68</td>
<td>68</td>
<td>65</td>
</tr>
<tr>
<td><strong>Final</strong></td>
<td>78</td>
<td>107</td>
<td>88</td>
<td>88</td>
<td>90</td>
</tr>
</tbody>
</table>

- **Date of Final Exam:** December 14, 2005
- **Meeting with Student No. 1:** December 12, 2005
- **Meeting with Student Nos. 2 & 4:** December 2, 2005
- **Meeting with Student No. 3:** December 8, 2005

The final was worth 100 points with a 10 bonus question.
Conclusion

We *can* significantly increase learning by...

• teaching students *how* to learn
• *not judging* student potential on initial performance
• encouraging students to *persist in the face of initial failure*
• encouraging the use of *metacognitive tools*
An Awesome Partner in Helping Students Succeed

University College/Center for Academic Success

Providing Quality Service to Every Student Every Day

The University System of Georgia designates Savannah State University as an “access institution.” As an access institution, the University is charged with providing an opportunity for individuals to earn a college degree who may have difficulty entering college because of various cultural, psychosocial and socio-economic issues, which have been shown to have a direct impact on their level of educational ability to attain a college degree.

The creation of University College (UC) at Savannah State University is predicated on the “access” component of the University’s mission. The focus of University College and the services provided by the University College/Center for Academic Success (CAS) are directly connected. These two entities together support the enrollment growth, retention and persistence goals of the University.

University College/University College/Center for Academic Success provides comprehensive academic support classes, services and resources specifically designed to enhance student academic achievement and success. Resources provided include specialized advisement, testing and tutoring services. UC/CAS assists students with developing a roadmap for success as they work toward their academic goals.
Special Note

Please also visit the CAS website at www.cas.lsu.edu. We have on-line workshops that will introduce you and your students to effective metacognitive strategies.

Have fun teaching your students powerful metacognitive strategies that will lead to increased critical thinking and problem solving skills!

Saundra McGuire
Useful Websites

- www.cas.lsu.edu
- www.howtostudy.org
- www.vark-learn.com
- www.drearlbloch.com
- Searches on www.google.com
Additional References


  [http://academic.pg.cc.md.us/~wpeirce/MCCCTR/metacognition.htm](http://academic.pg.cc.md.md.us/~wpeirce/MCCCTR/metacognition.htm)

  *Excellent student reference*
Acknowledgments

• LSU Center for Academic Success
• Dr. Elzbieta Cook, LSU General Chem Instructor
• Vice President Isiah Warner and the Office of Strategic Initiatives
• Faculty collaborators at LSU and elsewhere
• All of the students who changed their attitudes and behaviors and showed me that this approach works!