Get Students to Focus on Learning Instead of Grades: Metacognition is the Key!

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Mission
Missouri S&T integrates education, research and application to create and convey knowledge ... and helps solve the world’s great challenges.

Vision
Missouri S&T will be the leading public technological research university for discovery, creativity and innovation.

We will cultivate curiosity, creativity and confidence in our graduates...
Desired outcomes

- We will understand why many students spend little time studying and do not know how to learn
- We will have concrete learning strategies that faculty can teach students to increase learning, and we will be committed to trying them
- We will have more resources for our students
- We will view our students differently
- We will see positive changes in our students’ performance and self-perception
- We will spend time reflecting on improving our teaching and our students’ learning
Metacognition

The ability to:

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

Why don’t many students know how to learn or how to study?

It wasn’t necessary in high school
### Data from UCLA Higher Education Research Institute (HERI)
#### First Year Student Survey - 2010 - 2013

<table>
<thead>
<tr>
<th>Year</th>
<th>% who spent &lt; 6 hours/wk on homework</th>
<th>% who graduated from HS 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>
</tbody>
</table>

![Graph showing the trend of % of students who spent < 6 hours/wk on homework and % who graduated with an A average from 2010 to 2013.](http://www.heri.ucla.edu/)
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...
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 → Current grades

MIND THE GAP

Productive behavior → Desired grades
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
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
Let’s Revisit Travis

47, 52, 82, 86

Problem: Reading Comprehension

Solution: Preview text before reading*
Develop questions*
Read one paragraph at a time and paraphrase information

*Develop anticipatory set
Voyage of Christopher Columbus

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 TYPIFICIES 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

Anticipatory set CAN interfere!

Let’s look at the car on the next slide...
Is this a 2-door or 4-door car?
Revisiting Dana

Dana, *first year physics student*

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

**Problem:** Memorizing formulas and using on-line solutions help for problems

**Solution:** Solve problems with no external aids and test mastery of concepts
Why the Fast and Dramatic Increase?

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

How accurate are you?

Count the vowels in the words on the next slide.
Dollar Bill
Dice
Tricycle
Four-leaf Clover
Hand
Six-Pack
Seven-Up
Octopus
Cat Lives
Bowling Pins
Football Team
Dozen Eggs
Unlucky Friday
Valentine’s Day
Quarter Hour
How many *words* or *phrases* from the list 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* from the list do you remember?
What were two major *differences* between the 1\textsuperscript{st} and 2\textsuperscript{nd} attempts?
1. We knew what the task was

2. We knew how the information was organized
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***


Bloom’s Taxonomy

Remembering

Understanding

Applying

Analyzing

Evaluating

Creating

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.

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

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

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

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/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 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

- Level 1: 21%
- Level 2: 35%
- Level 3: 25%
- Level 4: 13%
- Level 5: 3%
- Level 6: 3%
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 did you have to operate to make A’s and B’s in high school?

1. Remembering 28%
2. Understanding 36%
3. Applying 0%
4. Analyzing 25%
5. Evaluating 8%
6. Creating 3%
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
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
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

![Bar chart showing the percentage of students who chose each level of Bloom's taxonomy.](chart.png)
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)
How do we teach students to move higher on Bloom’s Taxonomy?

Teach them the Study Cycle*

*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

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**Intense Study Sessions**

- **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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**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.

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Center for Academic Success

B-31 Coates Hall • 225.578.2872 • www.cas.lsu.edu
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
Two Valuable References


Mindset Matters!


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 Mindset Response</th>
<th>Growth Mindset Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Challenges</strong></td>
<td><em>Avoid</em></td>
<td><em>Embrace</em></td>
</tr>
<tr>
<td><strong>Obstacles</strong></td>
<td><em>Give up easily</em></td>
<td><em>Persist</em></td>
</tr>
<tr>
<td><strong>Tasks requiring effort</strong></td>
<td><em>Fruitless to Try</em></td>
<td><em>Path to mastery</em></td>
</tr>
<tr>
<td><strong>Criticism</strong></td>
<td><em>Ignore it</em></td>
<td><em>Learn from it</em></td>
</tr>
<tr>
<td><strong>Success of Others</strong></td>
<td><em>Threatening</em></td>
<td><em>Inspirational</em></td>
</tr>
</tbody>
</table>
Sharing Strategies that Have Worked for Others Can Be Very Motivational
Top 5 Reasons Students Did Poorly 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 Students 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
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 61% to 77%!
Changes Faculty Have Made that *Improved* Learning and Performance

• Provide learning strategies information to students after Test 1, and tell them about mindset
  *(Psychology Professor at Southern Crescent Technical College, 2013)*

• Increase the frequency of tests from three per semester to biweekly *(Mathematics Professor at Miles College, 2013)*

• Have students determine their learning style and write reflection on how they will use the information *(Entomology Professor at LSU, 2009)*

• Present one 50 minute session on metacognition, Bloom’s Taxonomy, and the Study Cycle *(Chemistry Professor at Middle Tennessee State University, 2012)*

• Partner with the learning center to teach metacognitive strategies *(Faculty at many institutions)*
### LSU Analytical Chemistry Graduate Student’s Cumulative Exam Record

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>9/04</td>
<td>Failed</td>
<td>10/05</td>
<td>Passed</td>
</tr>
<tr>
<td>10/04</td>
<td>Failed</td>
<td>11/05</td>
<td>Failed</td>
</tr>
<tr>
<td>11/04</td>
<td>Failed</td>
<td>12/05</td>
<td>Passed best in group</td>
</tr>
<tr>
<td>12/04</td>
<td>Failed</td>
<td>1/06</td>
<td>Passed</td>
</tr>
<tr>
<td>1/05</td>
<td>Passed</td>
<td>2/06</td>
<td>Passed</td>
</tr>
<tr>
<td>2/05</td>
<td>Failed</td>
<td>3/06</td>
<td>Failed</td>
</tr>
<tr>
<td>3/05</td>
<td>Failed</td>
<td>4/06</td>
<td>Passed last one!</td>
</tr>
<tr>
<td>4/05</td>
<td>Failed</td>
<td>5/06</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Began work with CAS and the Writing Center in October 2005.
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 on 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.
...I am a **junior at Weber State**. I was present on Thursday for your presentation on meta cognition. Before I share the effect it is already having I would like to tell you about myself. I am a high school drop out, "class" of 06', I started college in 2011...

...I have tried the suggestions you gave in your presentation, and it was like magic, seriously. When I was studying my chemistry this past week, even if I have to reference my outline multiple times to stay on track, **organizing my information differently** some how has made what I was study at the time stick so much better.

...not only **do I feel I am learning more efficiently and I feel like my self esteem is going up**. But it is also allowing me the much needed little bit of extra time to spend with my wife and kids because **I am understanding concepts quicker and better**. Thank you again so much. **These methods are changing my life, making me a better student, and using these concepts in everyday life is making me a better person.**
2004 National College Learning Center Association
Frank L. Christ Outstanding Learning Center Award
Undergraduate Advising Office

106 Campus Support Facility, 1201 N. State St., Rolla, MO, 65401 - Phone: (573) 341-4424 - Fax: (573) 341-4152 - Email: advising@mst.edu

Home
Alert System
Academic Advising Handbook
Academic Advising Conference Series
Advisor Resources
Student Resources
On-Track

Academic Resources

LEAD: Learning Enhancement Across Disciplines
LEAD provides learning assistance for over 45 courses in the form of collaborative learning centers and drop-in tutoring. It begins the second week of classes and ends on the Thursday of the last week of class.
http://lead.mst.edu/index.html

Writing Center: 113 Campus Support Facility
Fall Schedule: September 20 – December 10
Monday-Thursday 10:00 am – 6:00 pm
Friday 10:00 am – 2:00 pm
Sunday 12:30 pm – 5:00 pm
http://writingcenter.mst.edu/

Math Department Help
Math Help Room provides assistance for Math 2-22 and statistics, G11 Harris Hall. The schedule can be found online.
We can significantly increase student learning!

- We must teach students the learning process, provide specific strategies and motivate students to use the strategies.
- We must not judge student potential on initial performance.
- We must encourage students to persist in the face of initial failure.
- We must encourage the use of metacognitive tools.
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 a *significant increase* in student learning, retention, graduation rates!
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

*Excellent student reference*