Metacognition

The Key to Acing Courses
Student results

• After getting a presentation like this students have had remarkable turnarounds:
  – Travis: 47, 52, **82, 86**
  – Joshua: 68, 50, 50, **87, 87, 97, 90**
  – Dana: 80, 54, **91, 97, 90**

• How did they do it? They learned the secrets of metacognition

• Study to learn, not to make a grade
Reflection

• Did you think the exam was difficult?
Reflection

• Did you do less well on the exam than you wanted to?
Reflection

- Usually students are not good judges of how well they have mastered the subject.

- Fortunately, it does not matter how you did on the first exam – you can still do well in this course!
One strategy

- One strategy that can be used to drastically improve your performance is as follows:
  - Prepare & teach the material to a friend who may or may not be in the same course
  - Teach it to a family member or stuffed animal
  - By trying to explain concepts in a way that others can understand, you become aware of the gaps in their understanding or aware of details that are not clear to you
  - Follow this up by clearing up gaps in knowledge yourself, by talking to another student in the class, the GA, a lab instructor, or me
About this presentation

- This presentation is based on the teachings of Dr. Saundra McGuire, a 43-year veteran of college level STEM instruction

- What you will get out of this presentation:
  - You will analyze your current learning strategies
  - You will understand exactly what changes you need to make in order to get an A
  - You will have concrete strategies to use during the rest of this semester and you will use them in this course and every course
  - You will be a more efficient learner by studying smarter, not harder
Reflection

• What is the difference between studying and learning?
Reflection

• Given an upcoming exam, would you work harder to make an A on the exam or would you work harder if you had to teach a review session the day before the exam to the entire class?
Reflection

• How many of you are in study mode?
• How many of you are in make-an-A mode versus teach-the-material mode?
Reflection

- You need to be in learn & teach-the-material modes – if you can do this then you will do much better on exams and learn more broadly, deeply, and securely.
Why do you need to work harder / differently in college as compared to high school?
Metacognition: become an expert learner

- What is metacognition?
- The ability to:
  - Think about thinking
  - Be consciously aware of oneself as a problem solver
  - To monitor and control one’s mental processing
  - To be aware of the type of learning that you are doing
An exercise...

- On the next slide, count the vowels
- You have 45 seconds
An exercise...

- 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
An exercise...

- How many vowels?
An exercise...

• How many words or phrases do you remember?
An exercise...

- Let’s take a look at the words again
- Is there a pattern they are arranged according to?
An exercise...

- Dollar bill  
- Dice  
- Tricycle  
- Four-leaf clover  
- Hand  
- Six-pack  
- Seven-Up  
- Octopus  
- Cat lives  
- Bowling pins  
- Football team  
- Dozen eggs  
- Unlucky Friday  
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- Quarter Hour
An exercise...

- **Now** how many words or phrases do you remember?
An exercise...

- What were the two major differences between attempt 1 and attempt 2?
An exercise...

- What were the two major differences between attempt 1 and attempt 2?
- 1: We knew what the task was
- 2: We understood how the information was organized
Being an efficient and expert learner

- Do “think aloud” exercises
- Constantly ask yourself “why” and “what if” questions
- Always test your understanding by verbalizing or writing about concepts – practice retrieval of information
- Move up Bloom’s taxonomy by comparing and contrasting, thinking of analogies, thinking of new pathways, etc.
Bloom’s taxonomy

- **Creating** – Put elements together to form a functional whole, reorganize elements into a new pattern
- **Evaluating** – Make judgments based on criteria & standards through checking and critiquing
- **Analyzing** – Break material into parts, determine how parts relate to each other and an overall structure
- **Applying** – Carry out a procedure via executing or implementing
- **Understanding** – construct meaning from oral/written/graphic messages through interpreting, summarizing, comparing, and explaining
- **Remembering** – retrieve/recognize/recall knowledge from long term memory
Bloom’s taxonomy

• Analogy – Goldilocks: (from bottom up)
  - **Remembering** – Recalling what Goldilocks used at the bears’ home
  - **Understanding** – Knowing why Goldilocks preferred baby bear’s chair, bed, and porridge
  - **Applying** – Figuring out what items Goldilocks would use in someone else’s home
  - **Analyzing** – Reason about if bears could even eat out of bowls
  - **Evaluating** – Generate reasons as to why Goldilocks actions would be considered justified or unconscionable by others
  - **Creating** – Create a new story featuring Goldilocks with different themes and values
Bloom’s taxonomy

- To make A’s or B’s in high school, what level did you need to be on?
  - Remembering
  - Understanding
  - Applying
  - Analyzing
  - Evaluating
  - Creating
Bloom’s taxonomy

• To make A’s or B’s in **college**, what level do you need to be on?
  – Remembering
  – Understanding
  – Applying
  – Analyzing
  – Evaluating
  – Creating
Study cycle

- How do you climb the ladder? **Study cycle:**
  - **Preview** – Before class, pre-read
  - **Attend** – Go to class, ask questions, take meaningful notes
  - **Review** – Review after class as soon as possible, read notes, fill in gaps and come up with questions
  - **Study** – Repetition is key, ask why/how/what if
    - Have 3-5 intense short study sessions per day where you set a goal, study with focus, reward yourself, and review
    - Weekend review to make connections
  - **Assess** – Periodically perform reality checks
    - Am I studying effectively?
    - Do I understand the material well enough to teach others?
Effective metacognitive strategies

- **Preview** – Learning is more effective when you get the big picture first and the details later.
- **Read actively** – Highlight, take notes, jot down questions, create outlines, work example problems.
- **Use the textbook** – I fill in the small details automatically when I do things because I am experienced – you don’t have this experience so you need to use the book.
- **Students as teachers** – Prepare & teach materials to others (even imaginary friends), explain concepts in a way others can understand.
- **Create mock exams** – Deduce questions that may be on the exam and try to solve them.
- **Aim for 100% mastery, not 90%** - Have you ever neglected an area because it seems difficult? Did it hurt you? Instructors want to know who has 100% mastery! Additionally, this class is a prerequisite for others!
Effective metacognitive strategies

- On a 1-10 scale, how different are the strategies presented from the ones you use?

- On a 1-10 scale, how motivated are you to use the strategies?
Why people do poorly in CS 135

- Didn’t spend enough time studying
- Started homework too late
- Didn’t use the book
- Assumed they understood, but it did not stick and they were not able to apply it
Why people do well in CS 135

- Did preview/review for each class
- Started homework early
- Used book and did extra problems/work
- Practiced explaining information to others
From another course

- When students noted which strategies they used and did not use:
  - Students who do not use the strategies: average 56%
  - Students who do use the strategies: average 88%
What can you do starting now?

- 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
- Use metacognition to study smarter!
Making a plan

• What strategy will you commit to implementing?
Making a plan

• What strategy will you commit to implementing?

• If you don’t start implementing that strategy in the next 48 hours studies show that you never will
Challenge

• The first exam average was 63%
• I want a second exam average of 80%
• Commit to helping both yourself and other students
You have so many resources to utilize:

- Book & videos
- Academic Success Center
- Tutoring
- Lab instructors
- GA
- Me

Good luck, you can do it!