Metacognition: A Key to Cultivating Critical Thinking

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Learning Objectives

During this workshop, participants will:

- Define metacognition skills
- Discuss strategies that foster metacognition and critical thinking skills
- Model metacognitive strategies they can apply in the classroom
Critical Thinking Definition

Broward College defines critical thinking as a process of **evaluating** information by **questioning** and **testing** assumptions, **accepting** and **rejecting** arguments and/or perspectives, and **applying reasoning** to make informed decisions.
Critical Thinking Goal & Outcomes

Goal: To enhance students’ critical thinking skills
Students will be able to:

1. **Explain** questions, problems, and/or issues
2. **Analyze** and **interpret** relevant information
3. **Evaluate** information to determine potential conclusions
4. **Generate** a well-reasoned conclusion
Think-Pair-Share

What is the main problem evident in this clip?

How does this clip relate to a similar problem we see in many of our own students?

The “Think-Pair-Share” activity is based on this American Idol clip: http://www.youtube.com/watch?v=ztTCcTBXGJI

http://chronicle.com/article/MetacognitionStudent/130327/
Metacognition: Thinking about Thinking

“Interrelated set of competencies for learning and thinking”


“Process of reflecting and directing one’s own thinking”

Understanding how we think is the foundation of critical thinking

National Research Council (2001)
Metacognition: Thinking about Thinking

• Being consciously aware of yourself as a problem solver
• Planning, monitoring, and controlling your mental processing
• Accurately assessing your level of learning
What is going on in these stories?

THE "A" STUDENT: MELANIE

THE HAMSTER WHEEL: JOHN

What is going on in these stories?

Break into Pairs
A or B

- Person A Reads the “A” Student
- Person B reads The “Hamster Wheel” Student

Individually and in writing... Identify areas upon which the student can improve

Identifying Areas For Improvement

- All As gather on one side of the room
- All Bs on the other side of the room

Spend several minutes discussing:

1) areas upon which the student can improve
2) improvements you think are related to metacognition

Identifying Areas For Improvement

- Please return to your original pairs.

Take turns telling one another about your specific scenario and the areas of improvement that may be related to metacognition.

Use your notes and your collaboration.

Metacognition is about planning, monitoring, and evaluating one’s own thinking and learning.

Metacognition: Thinking about Thinking

- Active learning
- Critical thinking
- Reflective judgment
- Problem Solving
- Decision Making
- Motivation for Learning

Direct Paraphrasing

- Turn to your left: Explain the concept of metacognition to a 6 year old
- Turn to your right: Explain the concept of metacognition to your associate dean

What did you notice about your own metacognition?

http://www.lcc.edu/cte/resources/teachingtips/tip22.aspx
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Putting Metacognition Into Practice...
Peer Instruction Steps

http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1075&context=chemfacpub
This video explains why students should find value in the peer instruction process. Click on link: https://www.youtube.com/watch?v=G52407TB8B0
Learning: Punishment and Reinforcement

Behavior: Driving Fast
Do you want to increase this behavior?

YES!
It's NASCAR! You have to drive faster than anyone else to win. We will apply a reinforcer to increase the behavior.

NO!
We're not at the racetrack! Speeding is dangerous and against the law. We will apply a punishment to decrease the behavior.

**Reinforcement**

**Negative Reinforcement**
You don't like working in the family auto-body shop. Your family says you can work fewer hours if you win the next race. Taking away unwanted work increases the speeding behavior.

**Positive Reinforcement**
You win a trophy and a cash prize for going fast at the race. Adding desirable rewards increases your speeding behavior.

**Punishment**

**Negative Punishment**
The police officer confines your license. Taking away something desirable decreases your speeding behavior.

**Positive Punishment**
The police officer gives you a citation. Adding something undesirable decreases your speeding behavior.
Step 1
Pose High Level Question
1 min

Step 2
Give Students Time to Think
1 min

Step 3
Student Record Individual Answers (Vote)

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Step 4

Peer Discussion: Convince Your Neighbor and explain your reasoning (1-2 mins)

- Share how you thought about what the question was asking.
- Share the process you used to arrive at an answer you wanted to choose.
- What was your main reason for choosing your answer, and what were the main reasons you did not choose each of the other answers?
- How do your ideas compare with your neighbor's ideas?
- What was most confusing to you about this question?
- How confident are you in your answer? Why? What else would you need to know to increase your confidence?
Step 5
Student Record Revised Answers (Vote again)
Step 6
Show student responses
Step 7
Provide explanation 1 Min

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## Peer Instruction Best Practices

<table>
<thead>
<tr>
<th>DON’TS</th>
<th>WHY?</th>
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</thead>
<tbody>
<tr>
<td>Don’t ask easy recall questions</td>
<td>Students show greater gains with difficult questions</td>
</tr>
<tr>
<td>Don’t skip the individual vote</td>
<td>Forces students to think and increases engagement during discussion.</td>
</tr>
<tr>
<td>Don’t show the first vote bar graph if you plan to have the students vote twice</td>
<td>Students more confident, even if answer was incorrect</td>
</tr>
<tr>
<td>Don’t leave out the peer discussion</td>
<td>Students with correct initial vote improved their reasoning after discussion</td>
</tr>
<tr>
<td>Don’t omit the teacher explanation</td>
<td>Higher performance on final exam</td>
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Peer Instruction Evidence

1. Impact on learning in variety of disciplines (physics, geosciences, computer science, calculus, algebra, physiology)
2. Peer Instruction improves ability to apply material to novel problems (problem solving)
3. Lower attrition rates
4. Provide immediate feedback
5. Higher self-confidence
Reflection
Metacognitive Questions for Students

- What did you learn about this topic? (monitoring)
- With what did I have difficulty? (monitoring)
- What types of strategies can I use to deal with this difficulty? (problem solving-planning)
- What specific actions am I going to take this week to solve any difficulties? (planning)

http://www.slu.edu/blogs/cttl/2013/05/30/teaching-metacognition-through-critical-reflection-strategies-and-tools/
“Wrapper”

- An opportunity to reflect on your performance and how it could be improved.

- Tools developed at Carnegie Mellon to assist students with developing their metacognitive skills.

- Secondary task or requirement that accompanies an assignment or exam and asks students to reflect on their learning processes.

Exam Wrappers

TYPES OF QUESTIONS

- What did you do to prepare for the exam?
- Where did you make errors?
- What can you do differently to prepare for the next exam?

BENEFITS

- Easy to complete
- Are repeatable and flexible
- Can be used to help faculty adjust their teaching strategies and assist students in achieving learning outcomes
- Help students develop metacognitive skills:
  - Analyze own strengths and weaknesses
  - Identify study strategies that work
  - Adjust learning strategies

https://www.purdue.edu/learning/blog/?p=7050
Sample Exam Wrapper

(Course Name) Self-Assessment & Reflection  Student Name:

1. Approximately how much time did you spend preparing for this exam? __________
   a. What percentage of your preparation for Exam 1 was spent studying alone or with others?
      i. % alone: ____________________
      ii. % with others: ____________________

2. What percentage of your test preparation time was spent in each of these activities?
   a. Discussing content with classmates/students in other sections: ____________________
   b. Skimming the textbook: ____________________
   c. Reviewing your notes: ____________________
   d. Reading the textbook and other assigned readings: ____________________
   e. Reviewing homework questions: ____________________
   f. Reviewing graded quizzes: ____________________

3. As you look over your exam, think about how and where you lost points. Estimate the percentage of points you lost due to the following:
   a. % Not understanding a concept or term: ____________________
   b. % Not knowing how to begin the problem: ____________________
   c. % Not knowing how to apply the right formula: ____________________
   d. % Careless mistakes: ____________________
   e. Other reason (Please Specify): ____________________

4. Based on your responses to the questions, list three things you might do differently. For instance, will you spend more time studying or try to sharpen a particular skill. (Please be specific.)
   a. ____________________
   b. ____________________
   c. ____________________

5. What can we do to help support your learning and prepare for the next exam?

https://www.purdue.edu/learning/blog/?p=7050
Reflect-Pair-Share

Which of the steps in the cycle of metacognition are addressed by:

1) Peer Instruction Technique
2) Wrappers
Reflect on what you learned today by completing the following statements:

The most important idea (concept) I learned in today’s workshop was...

One way in which I can incorporate metacognition into my interaction with students is...

We do not learn from experience... we learn from reflecting on experience.

- John Dewey
Book Resources

- *Make it stick: The Science of Successful Learning* by Peter C. Brown, Henry L. Roediger III, Mark A. McDaniel
- *Mindset: The New Psychology of Success* by Carol S. Dweck, Ph.D.
- *How Learning Works: 7 Research-Based Principles for Smart Teaching* by Susan A. Ambrose, Michael W. Briąches, Michele DiPietro, Mana C. Lovett, Marie K. Norman
- *What the Best College Teachers Do* by Ken Bain
Video Resources

https://www.youtube.com/watch?v=dUqRTWCdXt4 (TED Talk on Metacognition)

https://www.youtube.com/watch?v=Tr37GOSEukw (APA Meta-studying: Teaching Metacognitive Strategies to Enhance Student Success)

Videos for students

http://www.samford.edu/departments/academic-success-center/how-to-study/ (short clips to teach students about effective study techniques)

http://www.samford.edu/uploadedFiles/_Articles/Departments/Academic_Success_Center/How-to-Study-Teaching-Guide.pdf (Teacher study Guide to go with Videos for Students)
Resources


http://www.lifescied.org/content/11/2/113.full.pdf+htm

http://www.improvewithmetacognition.com/


https://matrix.scranton.edu/academics/ctle/goldschmidt/files/Reflective_Writing_Prompts.pdf
More resources

http://chronicle.com/article/MetacognitionStudent/130327/


http://www.slu.edu/blogs/cttl/2013/05/30/teaching-metacognition-through-critical-reflection-strategies-and-tools/
