Metacognition in the Classroom
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Sleep

What Constitutes Sleep?

During 90-120 minutes cycles, the brain performs different tasks during sleep:
Hours 1-2: Memories are consolidated in the hippocampus and prepared for storage.
Hours 2-6: Memories are moved to the cortex, where they are kept for long-term memory.
Hours 6-9: Memories are actively rehearsed and replayed in the cortex during REM sleep.

How Does Sleep Affect Learning?

Memory.
During REM sleep, your brain actively remembers and reviews information from the previous day.
Sleep for six hours after learning, and you show zero learning enhancement.
Sleep for 8-9 hours after learning, and memory performance improves by 25%.
Sleep zero hours after learning, and memory performance decreases by 50%.

Insight.
Sleep enables novel insight into complex problems
In a study, people were given a complex mathematical algorithm for solving problems. What they didn’t know is that there exists a simpler method for solving the same problems. When people were retested on the problems 12 hours later, those who had slept were nearly three times as likely to have discovered the simpler method.

Attention.
Sleep deprivation interrupts focus and attention
Without REM sleep, which happens most during the final 2-3 hours of sleep, the mind can be up to 50% less attentive to the mental cues that help establish memory. This means that when we're sleep deprived, we sit in class and watch it go by.
### What is my role today?

<table>
<thead>
<tr>
<th>Level</th>
<th>Scale</th>
<th>Example</th>
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<tbody>
<tr>
<td>Supra</td>
<td>International/Comparative</td>
<td>OECD, CCR, TIMSS</td>
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<tr>
<td>Macro</td>
<td>System/society/nation/state</td>
<td>National syllabi, Department of Education</td>
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<tr>
<td>Meso</td>
<td>School/institution</td>
<td>Deerfield Academy, PS 130, Sorbonne</td>
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<tr>
<td>Micro</td>
<td>Classroom</td>
<td>My English classes, EdX “Justice” course</td>
</tr>
<tr>
<td>Nano</td>
<td>Individual/personal</td>
<td>Tutoring student, Khan Academy consumer</td>
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from Jan Van Der Akker “Curriculum Design Research” in *An Introduction to Educational Design Research* (2007), via the CCR website

### This talk:

Supra

Macro

Meso

Micro

Nano
Plan:

From whence, metacognition?
How I found metacognition. Or how it found me.

Metacognition, what art thou?
How I came to understand what metacognition means.

Metacognating… Um, metacogitat--… uh… Practicing metacognition
What teaching metacognition looks like in several classrooms.

The trouble with metacognition is… [Flow chart]
A pedagogical puzzle, partially solved

Some remaining challenges
How supra-level workers can help meso-, micro-, and nano-level workers
From whence, metacognition?

I. Changing Paradigms
### From whence, metacognition?

#### 1. Changing Paradigms

#### 2. Bloom, et al...

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<td>Evaluation</td>
<td>Create</td>
<td>Self-System Thinking</td>
<td>Communicate</td>
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<td>Synthesis</td>
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<tr>
<td>Application</td>
<td>Apply</td>
<td>Analysis</td>
<td>Integrate</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Understand</td>
<td>Comprehension</td>
<td>Manage</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Remember</td>
<td>Retrieval</td>
<td>Access</td>
</tr>
</tbody>
</table>

**Lesson learned:**

*We’re only allowed six educational objectives...*
From whence, metacognition?

1. Changing Paradigms
2. Bloom, et al...
3. Cognitive Science
From whence, metacognition?

1. Changing Paradigms
2. Bloom, et al...
3. Cognitive Science
Metacognition, what art thou?
(a teacher’s practical guide)

Awareness and Regulation of:

- ✅ ...one's own level of **mastery**
- 🔗 ...the **strategies** that enable mastery
- ⚙️ ...the **mechanics** that make strategies work
“Faith” is a fine invention
For Gentlemen who see!
But Microscopes are prudent
In an Emergency!

Emily Dickinson

Instructions: ← Strategy!
1. Scan the poem
2. Read the poem for literal meaning
3. Read the poem for figurative meaning

Mechanics:
← Organizes the task
← Creates prior knowledge
← Works through proximal development
Metacognition, what art thou?
(a teacher’s practical guide)

“Students learn strategies more effectively when the strategies are taught within the context of subject specific domains and ongoing learning tasks.”
- Ormrod, citing many

Cognitive and non-cognitive (or metacognitive) skills and dispositions must be taught in the context of content.
- Pete
From whence, metacognition?

Metacognition, what art thou?

Practicing metacognition

The trouble with metacognition is… [Flow chart]

Some remaining challenges
Practicing Metacognition

Three domains for teaching metacognition:

Day 1 = class time
HW1 = out of class time

Day 2 = class time
HW2 = out of class time

... = class time
... = out of class time
Practicing Metacognition

Three domains for teaching metacognition:

Day 1  Day 2  ...

HW1    HW2    ...

= class time
= out of class time
= assessments
Practicing Metacognition

- Yellow = out of class time
- Green = class time
- Red = assessments

Metacognitive goals

- Awareness of mechanics
- Awareness of strategies
- Awareness of mastery

Activities that promote metacognitive thinking:

- Write chapter summaries while reading
- Use or create advance organizers
- Categorize history note cards
- Journal
- Feedback: start, stop, continue
- Discussion: cognitive science
- Discussion: character of success
- Teacher-articulated skills & behaviors
- Contextualization of one's own work
- Student-generated test & quizzes
- Student self-assessments

Additional context: residential life?

- Public disciplinary announcements
- Residential curriculum
- Exercises in character reflection

...
From whence, metacognition?

Metacognition, what art thou?

Practicing metacognition

The trouble with metacognition is... [Flow chart]

Some remaining challenges

Mihaly Csikszentmihalyi’s “Flow”
The trouble with metacognition is…

Csikszentmihalyi, and the state of Flow

- Intense and focused concentration on the present
- Distortion of temporal experience (loss of sense of time)
- Merging of action and awareness
- Loss of reflective self-consciousness
- Sense of personal control over the situation or activity
- Experience of the activity as intrinsically rewarding (autotelic)

Metacognition

vs. Planning?

vs. Monitoring?

vs. Evaluating?

Either/or? …Both/and?
Deep immersion!

Analogous to cycles of immersion and metacognition?

Periods of reflection

Awake

REM

Stage 1

Stage 2

Stage 3

Stage 4

Deep immersion
From whence, metacognition?

Metacognition, what art thou?

Practicing metacognition

The trouble with metacognition is… [Flow chart]

Some remaining challenges
“The messy world of classroom learning creates a situation in which different goals compete for students’ attention.”
(Boekaerts & Corno, 2005)

What is the hierarchy of goals?
Education needs its Alexandria.
From whence, metacognition?

Metacognition, what art thou?

Practicing metacognition

The trouble with metacognition is… [Flow chart]

Some remaining challenges
From whence, metacognition?
1. Changing Paradigms
2. Bloom, et al...
3. Cognitive Science

Practicing metacognition
Outside of class
In class
Through assessments

Some remaining challenges:
What is the hierarchy of goals?
Education needs it Alexandria.

Metacognition, what art thou?
Awareness and regulation of...
...one’s own level of mastery
...the strategies that enable mastery
...the mechanics that make strategies work

The trouble (for me) with metacognition is...
Flow vs. Metacognition

And lastly?
Want Quick, Accurate Thinking? Ask a Musician

Tom Jacobs

New research finds musical training appears to sharpen our ability to detect our own mistakes, and rapidly make needed adjustments.

We all want to stay sharp-witted as we age, which explains the recent proliferation of brain games and puzzles. But newly published research suggests a low-tech way of retaining our mental agility: Learn to play a musical instrument.

According to this research, people who spend many hours in the practice room not only process information unusually efficiently, but they also do a superior job of not letting occasional errors derail them.

These findings “suggest that playing a musical instrument might improve the ability to monitor our behavior and adjust our responses effectively when needed,” writes a research team led by cognitive neuroscientist Ines Jentzsch of the University of St Andrews. “As these processes are amongst the first to be affected by cognitive aging, our evidence could promote musical activity as a realistic intervention to slow or even prevent (one type of) age-related decline.”

Music study could be “a realistic intervention method to slow or even prevent age-related decline in frontal brain functioning.”

In the journal Neuropsychologica, the researchers describe an experiment featuring 36 young adults. They were divided into four groups: Musicians who had accumulated at least 5,000 hours of practice; those who had clocked 2,000 to 5,000 hours; those who had studied less than 2,000 hours; and a control group with no musical experience.
Le Fin!