A Metacurriculum on Metacognition:
What Instructors and Students Learn From Thinking About Learning

Karl Wirth
Macalester College

Knowledge Surveys

- Content & skill objectives of course
- Span levels of thinking (Bloom levels)
- Students indicate perceived knowledge/ability

Knowledge Surveys and SRL

- Goal-Setting
- Monitoring
- Self-Assessment

Let’s Take a Quiz

Respond with:
1. I don’t know
2. I know some
3. I know it

Knowledge Surveys

- Content & skill objectives of course
- Span levels of thinking (Bloom levels)
- Students indicate perceived knowledge/ability
**Expert Learners**

- **Metacognitive Knowledge** (declarative, procedural, conditional)
  - Personal Resources
  - Task Requirements
- **Metacognitive Control** (self-regulation)
  - Plan
  - Monitor
  - Evaluate
  - Reflect
- **Reflection**

*Modified from Ertmer and Newby (1996)*

**Example Survey Items**

<table>
<thead>
<tr>
<th>Items</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can recite the definition of a mineral.</td>
<td>Remember</td>
</tr>
<tr>
<td>I can describe the cooling of a basaltic magma using Bowen’s Reaction Series.</td>
<td>Understand</td>
</tr>
<tr>
<td>I can calculate the relief of a region using a map.</td>
<td>Apply</td>
</tr>
<tr>
<td>I can compare the generation of melts along convergent and divergent plate boundaries.</td>
<td>Analyze</td>
</tr>
<tr>
<td>I can evaluate three potential sites for suitability to host a municipal waste landfill.</td>
<td>Evaluate</td>
</tr>
<tr>
<td>I can construct a model of the origin of a suite of rocks from the Sonju Lake Intrusion.</td>
<td>Create</td>
</tr>
</tbody>
</table>

**Survey Items**

For each of the crystals shown, what crystal system does it belong to?

Answer: 
- a. No answer at this time
- b. Know more than 50%
- c. Know detailed answer

**Administering Knowledge Surveys**

- Single class, Unit, Course, Curriculum Paper (in-class)
- Electronic (in-class with clickers; out-of-class with learning management system)

Beginning of Course
End-of-Course
Pre-Exam
Graduating Seniors
Alumni
Now it is time to learn.

Pay attention!

You are going to be tested later…
(but you already know what’s on the test)
Prior Knowledge and Gains by Item

Exam & Predicted Scores

KS Results - Individuals

Exam & Predicted Scores
Exam & Predicted Scores

Comparison of Self-Assessments

<table>
<thead>
<tr>
<th></th>
<th>Pre-diction</th>
<th>Know. Surv.</th>
<th>Post-diction</th>
<th>Score</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prediction</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>KS</td>
<td>0.44</td>
<td>1.00</td>
<td></td>
<td></td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Post-diction</td>
<td>0.56</td>
<td>0.71</td>
<td>1.00</td>
<td></td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Score</td>
<td>0.25</td>
<td>0.61</td>
<td>0.48</td>
<td>1.00</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

“Map” of Learning for Dynamic Earth

Learning Gains
Utility of Knowledge Surveys

Course Design
- Clarification of course objectives and structure
- Improved organization and preparation

Students
- Full disclosure of course objectives and expectations
- Study guide
- Formative assessment tool
- Development of self-assessment skills

Instructors
- Assessment of learning gains
- Course assessment
- Assessment of instructional practices

Programs
- Program Objectives
- Student Learning
Metacurriculum for Metacognition

<table>
<thead>
<tr>
<th>Activity</th>
<th>Knowledge or Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Surveys</td>
<td>Goal-setting, Monitor. &amp; Eval.</td>
</tr>
<tr>
<td>Reading Reflections</td>
<td>Reflection &amp; Monitoring</td>
</tr>
<tr>
<td>How I Earned an “A”</td>
<td>Goal-setting &amp; Monitoring</td>
</tr>
<tr>
<td>Exam Wrappers</td>
<td>Refl., Monitoring &amp; Evaluation</td>
</tr>
<tr>
<td>Learning Reflections</td>
<td>Evaluation &amp; Goal-setting</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>Strategies for Thinking</td>
</tr>
</tbody>
</table>


Reading Reflections:
*Reflection and Evaluation*

- Completed after each reading assignment
- Short responses to a few questions
  - What is the main point of this reading?
  - What did you find surprising? Why?
  - What did you find confusing? Why?
- Submitted online before class
- Credit awarded for “reflective” submissions
Survey of Reading Strategies

Depth of reading
Environment
Reading Strategies
  • Pre-Reading
  • Reading
  • Post-Reading

Learning Reflections:

Goal Setting/Reflection-for-Action

Planning and Goal-Setting

Journal Activity:
Write a letter describing what you accomplished in this course. The letter should be dated for the end of the semester and written in the past tense. Tell me what you did, how you did it, and how your thinking and understanding changed as a result of it.

Begin your letter with:
I earned an “A” in this course because…

The Art of Possibility (Zander and Zander, 2000)
Wrappers: A Structured Reflection-on-Action

Exam “Wrapper”

- Self Evaluation
- Preparation Strategies
- Performance Analysis
- Planning

Achacosa (2004)
Lovett (2008)

Exam Preparation

Exam “Wrapper” Results

Study Strategies

Analysis of Errors
Learning Reflections:

Supporting Learning with Reflection-in-Action

Learning to Learn

- Purpose of Education
- Levels of Thinking
- Affective Domain
- Significant Learning
- Meanings of Learning
- Research on The Brain
- Intellectual Development
- Critical Thinking
- Metacognition
- Behavioral Dimensions of Grades

Reflecting on Learning

- What are the three most important things you have learned? Why?
- Describe the learning strategies that you are using.
- How might they be adapted for more effective learning?
- How does learning in this course relate to other courses?
Reflective Prompt

- What do you MOST wish your students understood about their own thinking and learning?

The Goal of Higher Education is...

“to help college students become **Intentional Learners** who can adapt to new environments, integrate knowledge from different sources, and continue learning throughout their lives.”

Intentional Learners

Becoming an **intentional learner** means: developing self-awareness about the reason for study, the learning process itself, and how education is used.

Intentional learners are **integrative thinkers** who see connections in seemingly disparate information to inform their decisions.
Intentional Learners are also “Self-Directing”

Self-directing learners are highly motivated, independent, and strive toward self-direction and autonomy. They take the initiative to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes.


Three Principles of Learning

1. Recognize/Address Preconceptions
2. Expert Knowledge
   - Deep foundation
   - Contextual framework
   - Organizational structure
3. Metacognition is Essential

Bransford et al. (2000)

Metacognition Involves Reflection

- What kind of problem is this?
- What is the best strategy for solving it?
- How will I know if I solved it correctly?
- How could I do it better next time?
- What additional information do I need?
- What use is this new information?
- How can I use my new understanding to solve different kinds of problems?

Pedagogical Challenge

- Metacognition is a “self-imposed internal conversation”
- Shown to improve transfer (Bransford et al. 2000)
- Easily assumed that students are doing it, or can develop on own; both assumptions are wrong
- Challenge is to keep students in constant contact with their metacognition
- Instruction must be explicit (Pintrich, 2002)
Affect – Beliefs About Intelligence

• “fixed” versus “growth” theories of intelligence
• Affects motivation to learn and persistence
• Students taught study skills and brain plasticity outperform control groups

Dweck’s “Fixed” vs “Growth” Mindsets

• avoid challenges
• give up easily
• see effort as fruitless
• ignore feedback
• be threatened by success of others
• embrace challenges
• persist in face of setbacks
• see effort as path to mastery
• learn from criticism
• find lessons and inspiration in success of others

Reflection & Learning

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
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<tbody>
<tr>
<td>Habitual Action</td>
<td>Minimal thought and engagement; memorization is emphasized; correlated with surface learning; tasks treated as unrelated activities; an attitudinal state of unreflectiveness</td>
</tr>
<tr>
<td>Understanding</td>
<td>Focuses on comprehension without relation to one’s personal experience or other learning situations; book learning that is understanding-oriented; learning stays within boundaries of preexisting perspectives</td>
</tr>
<tr>
<td>Reflection</td>
<td>Learning is related to personal experience and other knowledge; involves challenging assumptions, seeking alternatives, identifying areas of improvement; active engagement; characteristic of deep approaches to learning</td>
</tr>
<tr>
<td>Critical or Intensive Reflection</td>
<td>Highest level of reflective learning; learners are aware of why they think, perceive, or act as they do; as a result, learner likely alters or changes firmly held personal beliefs and ways of thinking</td>
</tr>
</tbody>
</table>

Modified from Mezirow (1991) by Kember et al. (2000)

Stages of Learning

<table>
<thead>
<tr>
<th>Stages</th>
<th>Representation of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformative Learning</td>
<td>Meaningful, reflective, restructured by learner – idiosyncratic or creative</td>
</tr>
<tr>
<td>Working with Meaning</td>
<td>Meaningful, reflective, well-structured</td>
</tr>
<tr>
<td>Making Meaning</td>
<td>Meaningful, well-integrated, ideas linked</td>
</tr>
<tr>
<td>Making Sense</td>
<td>Reproduction of ideas, ideas not well linked</td>
</tr>
<tr>
<td>Noticing</td>
<td>Memorizing representations</td>
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Moon (1999)