Improving Metacognitive Skills of 2nd year Environmental Science Students: What to Measure?

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Premise: Optimal courses include Goals ➔ Assessment ➔ Active learning.  
Consequence: If some goals are 'metacognitive', how to assess them?

Current practice

UBC’s Environmental Sciences Program
An integrative, cross-disciplinary approach to the study of sciences underlying environmental issues facing societies.

http://www.ensc.ubc.ca/

Potential for further measurement of metacognition

Background (preliminary)  
Characteristics of metacognition (Sources in brackets) 
- Three "properties" (3): Aptitudes, Events, Context  
- Four strategies: planning, monitoring, evaluating, modifying (2,4)  
- Reflective capacity (1, 8)

A few options for measuring metacognition

Aptitudes (3)  “are you able to ...” or “what are your tendencies?”
- Self report questionnaires (2, 3, 4, 6)
  - (eg LASSI, MSQ, CLASS, EOT, custom, etc.)
- Interviews (structured, unstructured, etc.) (2, 3)
- Teacher judgments (ad-hoc or probing)
- Longitudinal measurement may be possible

Events (3) “what do you do when ...”
- Think aloud measures
- Error detection tasks
- Trace methodologies, e.g. coding questions posed.
- Longitudinal tracing of skills via CPNs & CIQ
- Observations of performance (2, 3)
- “What do you notice” (novice – expert distinction)
- Invention activities with pre-post assessments (11)
- Wrappers (5)
- Domain specific activity strategies
  - eg: A. Schoenfelt & math problem solving; (12)
  - Diagnostics (pre-course & possibly post-course) (6)

Measurement: egs. of caveats & challenges: (3)
- Are students addressing learning or well-being goals?
- Is reflective or reactive behavior being targeted?
- What interactions are there between the setting and interventions?
- Choice of model affects measurement options.
- Dynamic processes: targets may be affected by measurement.
- What units? What time scales? Sampling "what?"
- Technical & statistical issues with complex data.
- Efficiency & costs: needs for longitudinal studies.

Mapping envr200 learning activities onto metacognition model components

Learning environment, products, and potential for measuring

CIQ examples: feedback about learning & the course: (9)
- CIQ’s: “... good to know what peers have written ... so many thoughts in common ...
- Individual’s learning: “... most engaged while explaining my group’s poster to others...
- Logistics: “... surprised by the lack of time provided to discuss group projects ...
- Interactions with others: “... distanced when some peers dominated discussions ...
- Other: “... I became a little frightened ... don’t think I’ve been committed enough ...

One Example: CIQ questions! Reflection with Feedback (9)
What made you feel most...
1. Engaged
2. Distanced
3. Affirming or helpful
4. Puzzling or confusing
5. Surprised

Activities to support these strategies [# per term]
1. Group poster sessions with peer review; (3)
2. Simulated Town Hall meetings; (3)
3. Writing newspaper articles about Town Hall meetings; (3)
4. Individual research papers: peer reviewed drafts; (2)
5. Individual research presentations with peer review; (1)
6. Assigned pre-class preparations, including posing questions for guest speakers, research assigs. etc.
7. Weekly CIQ: Critical Incidence Questionnaires (7). (13)

No "exams" ➔ Rubrics for most activities.

Characteristics mapped in Envr 200