Collaborative e-Portfolios to foster metacognitive inquiry thinking

Kathy Takayama, PhD
Executive Director, Sheridan Center for Teaching & Learning
Professor of Molecular Biology, Cell Biology & Biochemistry
Brown University
Providence, RI, USA

AAC&U STEM Conference – November 2014
Key ideas:

• Validate uncertainty as a crucial component of learning and inquiry.

• The ePortfolio as a developmental learning space for iterative opportunities to reflect on learning, understanding and science identity.

• Collaborative inquiry as a process for transformational learning through transitional experiences.
Learning outcomes for this workshop

• Articulate a framework for collaborative inquiry learning within/across disciplines.

• Create a plan for designing e-portfolio projects as a process for inquiry thinking (rather than an outcome of inquiry).

• Identify key points for integrating metacognition to enhance inquiry learning.
In the face of today’s hyper-accelerated, ultra-competitive global society, the preservation of opportunities for self-development and autonomous reflection is a value we underestimate at our peril.

-Richard Wolin
Metacognition (Flavell 1979*)

“Thinking about one’s own thinking”

• Planning how to approach a learning task
• Monitoring one’s comprehension
• Evaluating the process and progress of learning

As a scientist, when (and in what ways) do you reflect upon your process of thinking? How do you make this visible to students?

What opportunities do students have to reflect on their thinking in a course?

How is this documented/measured?
A “metacognitive” approach to instruction can help students learn to take control of their own learning by defining learning goals and monitoring their progress in achieving them.
Therefore, the teaching of metacognitive skills should be integrated into the curriculum within and across subject areas.
Adapted from: Stanger-Hall, K. F. (2012): List of cognitively passive and active learning behaviors that students reported in their study surveys

<table>
<thead>
<tr>
<th>Cognitively passive learning behaviors</th>
<th>Cognitively active learning behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>I previewed the reading before class</td>
<td>I asked myself: ‘How does it work?’ and ‘Why does it work this way?’</td>
</tr>
<tr>
<td>I came to class</td>
<td>I drew my own flowcharts/diagrams</td>
</tr>
<tr>
<td>I read the assigned text</td>
<td>I broke down complex processes step-by-step</td>
</tr>
<tr>
<td>I reviewed my class notes</td>
<td>I wrote my own study questions</td>
</tr>
<tr>
<td>I rewrote my notes</td>
<td>I reorganized the class information</td>
</tr>
<tr>
<td>I made index cards</td>
<td>I compared and contrasted</td>
</tr>
<tr>
<td>I highlighted the text</td>
<td>I fit all the facts into a bigger picture</td>
</tr>
<tr>
<td>I looked up information</td>
<td>I tried to figure out the answer before looking it up</td>
</tr>
<tr>
<td>I asked a classmate or TA to explain the material to me</td>
<td>I asked myself: ‘How are individual steps connected?’ and ‘Why are they connected?’</td>
</tr>
<tr>
<td>I asked myself: ‘How does this impact my life?’ and ‘What does it tell me about my body?’</td>
<td></td>
</tr>
</tbody>
</table>
High impact practices:

- Collaborative learning
- Authentic inquiry
- Integrating metacognition
Integrating reflective practices within formative assessments
How do I know when I’ve been effective as a teacher?

Students take ownership of their learning.

Students apply their understanding through experiential learning.

Students are comfortable with uncertainty.

Students integrate insight across the disciplines to solve problems.
Developing students’ awareness of their learning across the curriculum
Learning

Trends/Forces:
Specialization  Technology
Globalization  Collaboration

Two common goals:
Expertise (routine vs. adaptive)
Flexibility

How do we get there?
Faculty view of traditional scholarly steps vs today’s student’s view of multiple, individual pathways.
Concerns

- A learning culture that is less interested in the process or journey?

- Focus on understanding a discipline vs. developing an understanding of oneself. (*what motivates me? how do I learn?*)
Barriers to making connections beyond the major or discipline

Discipline-centered practices*
  * pervasive
  * routine
  * habitual

Focus solely on expertise.

* See Shulman’s “Signature pedagogies”.
“Unpacking” our expertise
Case study:

**Introductory Microbiology**

- 280 students
- Each week: 2 lectures, 1 recitation (tutorial), 1 lab
- lab & recitation groups: 12 – 15 students/group
Scientific Research
Process of scientific inquiry

**Scientific Method**

- **Purpose**: State the problem.
- **Research**: Find out about the topic.
- **Hypothesis**: Predict the outcome to the problem.
- **Experiment**: Develop a procedure to test the hypothesis.
- **Analysis**: Record the results of the experiment.
- **Conclusion**: Compare the hypothesis to the experiment’s conclusion.

**Flowchart**

1. Ask Question
2. Do Background Research
3. Construct Hypothesis
4. Test with an Experiment
5. Analyze Results
   - **If Hypothesis is True**
   - **If Hypothesis is False or Partially True**
   - Report Results

**Process Steps**

- Think! Try Again
Discrepancies between the practice of scientific inquiry and the pedagogy of scientific inquiry
Iterative reflection and critical analysis

- hypothesize
- define aims
- design experiment
- perform experiment
- outcomes and results
- ask questions
- interpret
- analyze
- communicate
Making student thinking visible: the collaborative e-Portfolio
scaffolding inquiry: mapping the learning process

• Validate uncertainty as a crucial component of learning.
• Self-authorship (Baxter-Magolda 2004)
• Decoding the disciplines (Middendorf & Pace, 2004)
• Epistemologically authentic inquiry (Chinn & Malhotra, 2002).
Collaborative reflection throughout the investigation
Three submissions to map the inquiry process

- week 5
- week 10
- week 14
Metacognitive folio thinking: mapping the learning process
Collaborative e-Portfolio example

- week 5
- week 10
- week 14
• Ideas evolved cyclically → students reflect and contribute to an iterative dialogue

• Exploration beyond the formal course

• Being comfortable with “not knowing” - celebrating questions

• Self-authorship
Metacognitive folio thinking: validating uncertainty as part of the learning process

The ePortfolio as a learning space for reflection and collaborative analysis of learning positions
Students’ online discussions

“... the fungi that contaminated our plates may not necessarily be our own fault or carelessness as fungi overran the whole plate and it is inevitable that the inoculating loop touched some fungus along the way. I don't see this as a negative because it is a part of the unexpected factors that intervene with our progress. I look at this as a challenge, rather than a difficulty, which help us to think about the solution required to tackle this problem. And this is something we can reflect upon when constructing the E-poster.”
Metacognitive folio thinking: self-authorship
“Totally agree Dan. We should use version 3 of the poster as a learning tool and really focus on bringing it together conceptually. I would even suggest that we have a meeting (in a relaxed atmosphere) where we talk about anything that we are still confused about and help each other sort things out... I think this could be a really good revision that will make the poster even better and of course help us with the final...”
• Ideas evolved cyclically ➔ students reflect and contribute to an iterative dialogue

• Exploration beyond the formal course

• Being comfortable with “not knowing” - celebrating questions

• Self-authorship
The collaborative ePortfolio as a:

Transitional space
– shifts in learner experience, awareness of learning positions, comfort with uncertainty (liminality)

Transformational space
– sense of identity construction, collaborative reflection on group identity
“Visiting” other team e-Portfolios
Creating learning communities through collaborative ePortfolios

- Situate abstract tasks into **authentic context** (Relevance)
  - link to lab as well as students’ outside experiences

- Identify **process** of the task

- Vary **diversity** of situations and articulate **common** aspects

- **Sequencing** and **Scaffolding** activities:
  - global before local skills
  - increasing complexity
  - increasing diversity

- **Sociology** of the learning environment
  - situated learning
  - community of practice
  - intrinsic motivation
  - cooperation
Creation of reflective learning communities

• Transformation of the lab groups into reflective learning communities; a culture of peer learning and teaching.

• Deeper thinking, alignment of theory with practice.

• Students focused on critiquing the process of their investigation rather than stressing about achieving an “outcome”.

• Less anxiety about “not knowing”; recognition of “uncertainty” as an important step in the investigative process.
Making learning visible: a developmental process
“Our schools are generally still organized around answers rather than questions.”

- Michael Wesch
“Living the question”
Thank you

kathy_takayama@brown.edu