Scientific Literacy in the Context of Civic Reasoning: An Educational Design Problem

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Active, collective citizenship through responsible civic reasoning, empowered by tools of science and technology, is an important educational goal of our time.
Badger backer: I have seen a number of studies to say this will help. Why should I trust yours?

Wackwack: No, badgerbacker, you haven't seen even ONE study which suggests Walker's plan will help. If you had, you would've shared a link. Link, or you're a liar.

Rural Resident: An opinion based by some model used by a UW Madison professor, isn't that part of the reason we've fallen subject to bubbles and bubbles bursting???? . . .

Muir: . . . the best article [on education cuts] I've seen in my news trawl today has been this cap time interview . . .

http://host.madison.com/ct/news/local/health_med_fit/article_2888e8be-4fee-11e0-81f8-001cc4c03286.html Bobby Peterson said: They fear a population that is educated . . . [Walker] desires an uneducated public . . .

Ace4: Dear Muir, The only thing larger than your inflated opinion of yourself is possibly the utter lack of fiscal restraint. What a pompus #### you are.
Proposal: Use Full Model of Civic Reasoning in Science Education

• K-12
• Undergraduate Ed
• Graduate Ed
• Curricula
• Individual Students
• Individual Courses
Civic Reasoning Model

1. Seek understanding, common ground, and consensus on what constitutes problems worthy of research.

2. Leverage power structures to assure funding for important scientific research.

3. Design and conduct scientific research.

4. Critique research in scientific communities.

5. Use evidence to set policy or take action.

Case 1: HAL Online

• Basic Cognitive & Brain Science for Educators
  – I. Cognition and Culture
  – II. The Amazing Learning Brain
  – III. Learning Science in Reflective Practice
• 4-5 One-Week Lessons Per Unit
• Small Groups Online
• Problem-Based Learning
Phases of Civic Reasoning in HAL Online Lessons

Adventures in Argument: Should we invite this proposal?

1. Reaching consensus on what constitutes problem for research
2. Processes in funding.
3. Evidence-based decision making

Thinking as Hypothesis Testing: Design Evaluation Study

3. Conducting research
4. Critiquing research
4. Evaluating policy or action
Thinking as Hypothesis Testing: Goals

To deepen your understanding of a universal scientific model for good thinking. Be able to explain and identify examples of the following ideas, including their interrelationships. Be able to use them as tools for reasoning and critique:

1. dependent and independent variables
2. deductive and inductive reasoning
3. sample size, generalization, and related bias in reasoning
4. correlational and experimental evidence and their relative usefulness for making causal claims.
5. operationalizing and measuring variables
**Adventures in Argument: Goals**

Acquire concepts and skills enabling you to:

1. analyze and judge arguments made by others, including politicians, pundits, friends, relatives, and classmates.
2. improve your own thinking and ability to persuade by understanding the quality of the arguments YOU are making to yourself and others.
3. Improve learning in your small group (and beyond) by making sound arguments with science evidence and holding others accountable for argument quality.
You are the advisory board for the Gates Foundation, which has pledged substantial aid for Africa. You are screening presentations by leaders who wish to submit proposals for funding. There are many presentations and only 5-10% of them will be invited.

Patrick Awuah presents work on developing higher education for African leaders. He would expand the number of Ashesi University campuses in Ghana. His proposal will include a study to evaluate his project.

Does the presentation warrant a full proposal?
UNESCO will fund a study by a team of social scientists to evaluate Patrick Awuah’s causal hypothesis about the effects of Ashesi University. Your team wants this job and must prepare a proposal on how it will conduct the study.

Using ideas from Thinking as Hypothesis Testing, your team should design and propose a realistic (feasible) study that would shed light on the value of the program even if it were not able to answer the big question of whether leaders that think critically would improve a whole continent.
Contrasting Discourse & Reasoning

Adventures in Argument: Invite Proposal?

- Thoughtful discourse related to evidence-based decision making
  - Carefully analyzed argument in video
  - Considered value of the research problem
  - Examined quality of and differences between narrative vs. scientific evidence

Thinking as Hyp Testing: Design a Study

- Thoughtful discourse related to designing research
  - Examined technical, ethical, and practical issues related to obtaining scientific data and evidence
  - Referred to video for ideas about hypotheses and operationalization of measures and variables
Two Cases from Zalles

- *Practicing Democracy through Deliberative Discourse (P3D)*
  - Phase 1: Seeking common ground on what constitutes problems
  - Skills of constructive, generative discourse can be taught and modeled
  - Deliberative discourse vs. debate
  - Pilots: TPD, High School

- *Data Sets & Inquiry in Geoscience (DIGS)*
  - Phases 3, 5 & 6: Designing, conducting scientific research, using findings to set policy, evaluating policy effectiveness.
  - Focus on Assessment
  - Pilot: Online, High School
Controversial Issues Framed as Driving Questions

1. Should capital punishment be prohibited?
2. Should violent video games be prohibited?
3. Should greater numbers of immigrants be allowed into the US?
4. Should the government do more to regulate amounts of carbon dioxide emitted into the atmosphere?
P3D

• Controversial issues are strong or weak on the following dimensions:
  – Self interest
  – Moral implications
  – High stakes
  – Conducive to rational deliberation
Steps in P3D

1. Classify issue in terms of dimensions
2. Take a side to yes/no question
3. Read pro/con arguments and respond to questions
4. Participate in deliberative discourse within small groups
   1. What do you agree about?
   2. What did you agree to disagree about?
   3. What follow-up actions does group want to take?
Samples of Student Thinking from High School P3D Pilot

• Should capital punishment be prohibited?
  – Positions differed within group
  – Common ground in moral arguments (but arguments differed)
  – Would endorse new policy whereby murderers given choice of death of life in prison

• Should violent video games be banned?
  – Position framed in rational terms, not self interest
  – Strong interest in gathering research on causal effects
  – Would weigh research findings against dueling priorities of free speech vs. public safety
Conclusion

- It is feasible to use a full model of civic reasoning in science instruction.
- Attending to phases of civic reasoning influences forms of student reasoning in predictable and sometimes unpredictable ways.
- Research question: Can programs based on a full model of civic reasoning prepare young “digital natives” to employ their technological prowess more constructively to effectively engage in civic issues that have scientific import?