Utilizing Competing Narratives to Increase Critical Thinking Abilities

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What is Critical Thinking?

- **NOT** a random compilation of components (Willsen, 1995)
  - Integrated working system for education and life (Willsen, 1995)
- Characterized by ability to transcend disciplines (Kuhn, 1999)
- Analyze and evaluate information (Duron, Limbach, & Waugh, 2006)
- Purposeful, outcome-based thinking (Popil, 2011)
THE Definition

- Reasoned, purposive, and introspective approach
- To solving problems or addressing questions
- With incomplete evidence and information
- For which an incontrovertible solution is unlikely

Rudd, Baker, & Hoover (2000)
Purpose of Study/Methods

- Examine effects of competing narratives approach to increase students’ critical thinking abilities.
  - Entry level, semester-long natural resource management course – NRSM 101 (N = 209)
  - Critical Thinking Assessment Test (CAT)
  - Pre-test/post-test design
CAT

- NSF supported tool to assess critical thinking and problem solving
- 15 short-answer questions based on real-world situations
- Scoring completed by institution faculty
  - Opens dialogue on critical thinking development
  - Detailed scoring rubrics
- Measure effects of college education, POS, or course
- Evaluate information, creative thinking, problem solving, and communication
## Specific Skill Areas Assessed by the Critical Thinking Assessment Test

<table>
<thead>
<tr>
<th>Skill Area</th>
<th>Skill Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summarize the pattern of results in a graph without making inappropriate</td>
<td>Determine whether an invited inference in an advertisement is supported by</td>
</tr>
<tr>
<td>inferences</td>
<td>specific information</td>
</tr>
<tr>
<td>Evaluate how strongly correlational-type data supports a hypothesis</td>
<td>Provide relevant alternative interpretations for a set of results</td>
</tr>
<tr>
<td>Provide alternative explanations for a pattern of results</td>
<td>Separate relevant from irrelevant information when solving a real-world</td>
</tr>
<tr>
<td>Identify additional information needed to evaluate a hypothesis</td>
<td>problem</td>
</tr>
<tr>
<td>Evaluate whether spurious information strongly supports a hypothesis</td>
<td>Use basic mathematical skills to help solve a real-world problem</td>
</tr>
<tr>
<td>Provide alternative explanations for spurious associations</td>
<td>Identify suitable solutions for a real-world problem using relevant</td>
</tr>
<tr>
<td>Identify additional information needed to evaluate a hypothesis</td>
<td>information</td>
</tr>
<tr>
<td>Use/apply relevant information to evaluate a problem</td>
<td>Identify and explain the best solution for a real-world problem</td>
</tr>
<tr>
<td></td>
<td>Explain how changes in a problem situation might affect the solution</td>
</tr>
</tbody>
</table>
Course Setup

- Competing narratives
- Four writing assignments
  - 1 and 2 introduce students to grading, writing, structure, etc.
  - 3 and 4 to examine biases and information sources
Writing Assignments

Assignment

- #1 - Prove or disprove one of the myths presented by textbook, using at least one scientific source.
- #2 - Determine if the erosion rates on hill slope sites in selected fields are sustainable.

CAT Skill Areas

- Summarize a pattern of results
- Evaluate spurious information
- Separate relevant from irrelevant information
- Identify and explain the best solution
Writing Assignments

Assignment

• #3 - Is modern global warming abnormal and therefore a cause for concern? Compare and contrast the arguments.

• #4 - Is CO₂ the primary cause of modern global climate change and is it attributed to human activities? Compare and contrast the arguments.

CAT Skill Areas

• Summarize a pattern of results

• Provide alternative explanations

• Separate relevant from irrelevant information

• Identify additional information needed to solve a problem
Results

- Students scored statistically higher on the post-test in five of the fifteen skill areas as well as on the overall CAT score.

Table 1

<table>
<thead>
<tr>
<th>Skill area assessed</th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>$p^a$</th>
<th>Eff. Size$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate strength of correlational-type data.</td>
<td>0.81</td>
<td>1.78</td>
<td>**</td>
<td>+0.78</td>
</tr>
<tr>
<td>Identify additional info. needed to evaluate a hypothesis.</td>
<td>1.32</td>
<td>0.62</td>
<td>**</td>
<td>-0.68</td>
</tr>
<tr>
<td>Summarize pattern of results in a graph.</td>
<td>0.57</td>
<td>0.62</td>
<td>*</td>
<td>+0.61</td>
</tr>
<tr>
<td>Identify and explain the best solution for a real-world problem.</td>
<td>1.49</td>
<td>2.59</td>
<td>*</td>
<td>+0.59</td>
</tr>
<tr>
<td>Use/apply relevant information.</td>
<td>1.03</td>
<td>1.38</td>
<td>**</td>
<td>+0.51</td>
</tr>
<tr>
<td>Identify suitable solutions for a real-world problem.</td>
<td>0.65</td>
<td>1.030</td>
<td>*</td>
<td>+0.40</td>
</tr>
<tr>
<td>CAT total score.</td>
<td>15.25</td>
<td>18.05</td>
<td>**</td>
<td>+0.52</td>
</tr>
</tbody>
</table>

$^a$Probability of difference; $^b$Mean difference divided by pooled group $SD$ (0.1-0.3 = small; 0.3-0.5 = moderate; >0.5 = large effect).

* $p < 0.05$. ** $p < 0.01$. 
Conclusions

- Enrollment in a course similar to this one (semester-long, lecture/lab base, competing narratives) has the potential to positively influence students’ critical thinking abilities.
- Impelled students to construct new knowledge from inspecting their own previous experiences and opinions of global warming.
Discussion

- Potential for improved CT is evident, but intentionality is a must (curriculum development and delivery).
- CT is neither passive nor random.
  - We must push our students toward this type of thinking.
    - Questioning techniques
- Alternative approach to increasing students’ critical thinking abilities.
Closing Thoughts

- What are we truly doing to get our students engaged in critical thinking/analysis?
- Have we evaluated our CT outcomes or do we just assume we are integrating CT?

Thank You – Questions?