MAPPING REASONING FOR CRITICAL THINKING INSTRUCTION ACROSS DISCIPLINES AND INSTITUTIONS

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1. What word do you associate with critical thinking?

2. To whom do you think critical thinking is important?
   a) Employers
   b) Instructors
   c) Students
   d) All of the above

3. How effectively is critical thinking taught at institutions of higher learning?
   a) Very effectively
   b) Somewhat effectively
   c) Somewhat ineffectively
   d) Very ineffectively

4. What challenges face critical thinking instruction at institutions of higher learning?
   a) Insufficient instructor training
   b) Lack of consistent learning objective and assessment measures
   c) Student resistance
   d) Lack of student preparation and exposure
CRITICAL THINKING AT UW-STEVEN'S POINT

University of Wisconsin
Steens Point

“The General Education Program seeks to develop ... qualities of global citizenship in four distinct ways. After completing the general education curriculum, students will:

• Demonstrate critical thinking, quantitative, and communication skills necessary to succeed in a rapidly changing global society.
• Demonstrate broad knowledge of the physical, social, and cultural worlds as well as the methods by which this knowledge is produced.
• Recognize that responsible global citizenship involves personal accountability, social equity, and environmental sustainability.
• Apply their knowledge and skills, working in interdisciplinary ways to solve problems.”

https://www.uwsp.edu/gep/Pages/mission.aspx
Fall 1995
- Argument mapping introduced in the Philosophy Department.

Summer 2015
- Faculty from English, French, History, and Communication collaborated to explore the potential of argument mapping to facilitate critical thinking instruction in those disciplines.

Academic Year 2015 – 2016
- UW-Stevens Point selected argument mapping as the focus of its Quality Initiative in support of its continued accreditation through the Higher Learning Commission.
CRITICAL THINKING AT UW-STEVEN'S POINT

- Faculty Exploration Groups formed to discuss how argument mapping could be used to teach and assess critical thinking across the curriculum.

- Faculty from UW-Stevens Point conducted workshops in argument mapping for instructors at Mid-State Technical College and Gateway Technical College and extended the discussion of critical thinking to include dialogue mapping.

- We held additional critical thinking luncheons, broadened the focus from “argument” to “reasoning,” began meetings with local employers, and drafted critical thinking pilot for Fall 2018.
## CRITICAL THINKING AT UW-STEVENS POINT

### Where we are Now

<table>
<thead>
<tr>
<th>CT Pilot Fall 2018: 72 Sections, at 100, 200, 300 and 400 Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Art</td>
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<tr>
<td>• Biology</td>
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<tr>
<td>• Business</td>
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<tr>
<td>• Computer Information</td>
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<td>Systems</td>
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<td>• Computing and New Media</td>
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<td>Technologies</td>
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<td>• Communication</td>
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<td>• Education</td>
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<td>• English</td>
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<tr>
<td>• Food and Nutrition</td>
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<td>• Forestry</td>
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Our Goals

• Overarching framework for critical thinking instruction that
  ✓ Encompasses critical thinking as it appears across the curriculum and in the workplace
  ✓ Identifies specific competencies

• Critical thinking instruction throughout the curriculum that is
  ✓ Scaffolded
  ✓ Situated within larger framework

• Ongoing assessment of critical thinking learning outcomes.
SESSION OUTCOMES

Upon completion, participants will be able to

1. explain the difference between concept maps, argument maps, and dialog maps.

2. identify how graphical representations of reasoning can be applied across disciplines to teach and assess critical thinking skills.

3. identify some ways to use graphical representations of reasoning at their institution.
Upon completion, participants will be able to explain the difference between concept maps, argument maps, and dialog maps.
Concept Maps

The Forms of Energy

- Gravitational Energy
- Thermal Energy
- Potential Energy
- Nuclear Energy
- Mechanical Energy
- Electrical Energy
- Light Energy
- Kinetic Energy

The Ability to do Work

Sound Energy

The Energy due to Motion

The Energy due to Shape or Position

http://mrslagunasclass.wikispaces.com/
Critical Thinking

CRITICAL THINKING IS PURPOSEFUL, REFLECTIVE REASONING ABOUT WHAT CONCLUSIONS TO DRAW OR ACTIONS TO TAKE.
(adopted from Facione, “Critical Thinking: What It Is and Why It Counts”)

activities involving reasoning:
- Identifying Reasoning
- Communicating Reasoning
- Testing an Hypothesis

Identifying Elements
- Analyzing Reasoning
- Checking Answers

Tracking Relationships
- Assessing Elements
- Attempting to support a Conclusion

Elements
- (components of reasoning)
- (obstacles to reasoning)

Relationships between Elements
- Lack of Schema
- High Cognitive Load
- Unwillingness

Assertions
- Assertion / Assertion
- Graphical Representations

Questions
- Question / Assertion
- Dispositions

Support
- Objection
- Deliberate Practice
- corrected by

Graphical Representations
- corrected by

Objection
- Dependent
- Independent
- corrected by

Support
- Assertions
- corrected by

Assertions
- Questions
- corrected by

Questions
- corrected by
“Learning a second language requires students to focus upon things like conjugation, grammar, and sentence structure so familiarity with a second language improves students’ understand of their first language. Therefore, we should require all students at our institution to take (or test out of) two semesters of a second language.”

“We should require all students at our institution to take (or test out of) two semesters of a second language because familiarity with a second language improves students’ understanding of their first language since learning a second language requires students to focus upon things like conjugation, grammar, and sentence structure.”

We should require all students at our institution to take (or test out of) two semesters of a second language.

Familiarity with a second language improves students' understanding of their first language.

Learning a second language requires students to focus upon things like conjugation, grammar and sentence structure.
"Learning a second language requires students to focus upon things like conjugation, grammar, and sentence structure so familiarity with a second language improves students’ understanding of their first language. Therefore, we should require all students at our institution to take (or test out of) two semesters of a second language.

"We should require all students to take (or test out of) two semesters of a second language because familiarity with a second language improves students’ understanding of their first language since learning a second language requires students to focus upon things like conjugation, grammar, and sentence structure.

We should require all students at our institution to take (or test out of) two semesters of a second language.
“We should require all students at our institution to take (or test out of) two semesters of a second language because familiarity with a second language enhances intercultural competence and because we should do what we can to enhance our student’s intercultural competence.”
“Learning a second language requires students to focus upon things like conjugation, grammar, and sentence structure so familiarity with a second language improves students’ understand of their first language. Therefore, we should require all students at our institution to take (or test out of) two semesters of a second language. Additionally, familiarity with a second language enhances intercultural competence and we should do what we can to enhance our students’ intercultural competence.”
“We should require all students at our institution to take (or test out of) two semesters of a second language. Some people disagree, maintaining that students will resent a language requirement. In fact, however, students appreciate the importance of knowing a second language. And even if they didn’t, we can be justified in instituting requirements that students resent.”
“Learning a second language requires students to focus upon things like conjugation, grammar, and sentence structure so familiarity with a second language improves students’ understand of their first language. Therefore, we should require all students at our institution to take (or test out of) two semesters of a second language. Additionally, familiarity with a second language enhances intercultural competence and we should do what we can to enhance our students’ intercultural competence. Some people maintain that students will resent a language requirement. In fact, however, students appreciate the importance of knowing a second language. And even if they didn’t, we can be justified in instituting requirements that students resent.”
Argument Maps - Construction

What is my research question?

What is my answer to this question?

What is one reason to think my answer is true?

What is a different kind of reason to think my answer is true?

How does that reason connect to my answer?

How does that reason connect to my answer?

What is a reason to think my answer is false?

Is there reason to think that this objection is untrue?

Is there reason to think that this objection is irrelevant?

What is some support for my reason?
Argument Maps – Hypothesis Generation

Hypothesis

Question
"What?"
"How?"
"Why?"

Background Knowledge

Observation or
Partially Confirmed
Hypothesis
Argument Maps – Hypothesis Testing

Hypothesis $H$ is Partially Confirmed.
- or-
Hypothesis $H$ is Disconfirmed.

Experimental Prediction:
If $H$ is true, then under conditions $C$, $X$ will happen.

Experimental Result:
$X$ happened under conditions $C$.
- or-
$X$ did not happen under conditions $C$. 
Dialog Maps – Problem Solving

How can we achieve X?
Dialog Maps – Problem Solving

How can we achieve X?

Let's A.
Dialog Maps – Problem Solving

How can we achieve X?

Let's A.

We want X.

A will get us X.

A is no worse than other ways of getting X or of living without X.
Dialog Maps – Problem Solving

How can we achieve X?

Let's A.

We want X.
A will get us X.
A is no worse than other ways of getting X or of living without X.

Let's B.

We want X.
B will get us X.
B is no worse than other ways of getting X or of living without X.

B is better than A.
Dialog Maps – Problem Solving

How can we achieve X?

Let's A.

We want X.

A will get us X.

A is no worse than other ways of getting X or of living without X.

B is better than A.

Let's B.

We want X.

B will get us X.

B is no worse than other ways of getting X or of living without X.

B won't get us X.

Let's C.
Upon completion, participants will be able to identify how graphical representations of reasoning can be applied across disciplines to teach and assess critical thinking skills.
• Teaching critical thinking (la pensée critique) as visual thinking (la pensée visuelle) at all levels of instruction in Francophone world
  • 2016-2017 Wisconsin Teaching Fellow Scholarship of Teaching and Learning (SoTL) Project

Acknowledgments
• UW System’s Office of Professional & Instructional Development (OPID)
• UW-Stevens Point Office of Provost
• UW-Stevens Point College of Letters and Science
• UW-Stevens Point Department of World Languages and Literatures
• UW-Stevens Point French 340 students, Fall 2016
Different Maps – Different Functions

• In “Visual Mapping to Enhance Learning and Critical Thinking Skills” (2011), Héctor C. Santiago examines multiple tools and visual maps to capture different types of thinking processes:
  “picturing the thinking process (mind mapping), exploring the structure of knowledge (concept mapping), developing premises, counter arguments and conclusions around a contention (argument maps), exploring the learner’s own thinking process (®Thinking Maps)” (125).
MIND, CONCEPT & ARGUMENT MAPS

Instructor’s maps exemplify differences between mind and concept maps.
STUDENT WORK

• First Class Debate based on Molière’s play *Le Bourgeois gentilhomme*: Two Concepts Maps – “Happiness prevails over fortune” & “Money buys everything”

Students 1 & 2 (originals in French, translation is mine): Logical connectors are not present; information is ordered by color or position; associative flow prevails.
Student 3 (original in French, translation is mine): This map shows logical flow. It also included logical connectors for supporting claims (because), objections (but) and even a rebuttal (however).
Student 4: Original French is preserved to illustrate this exemplary work produced in the target language. The argument map includes several supporting claims with different types of evidence (citations from peer-reviewed articles, personal experiences, etc.) as well as complex counter-claims (objections and rebuttals). The logical flow is immediately visible and can be easily evaluated for its accuracy. This map was prepared with Rationale, an online argument mapping software, which supports several languages.

www.rationaleoneline.com
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Does Not Meet Expectations</th>
<th>Developing Towards Meeting Expectations</th>
<th>Meets Expectations</th>
<th>Exceeds Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formulating a Position</strong></td>
<td>Position (i.e. ultimate conclusion) is stated, but is simplistic and obvious.</td>
<td>Position is vague.</td>
<td>Position is clearly stated.</td>
<td>Position is clearly stated and thought-provoking.</td>
</tr>
<tr>
<td><strong>Confirmation</strong></td>
<td>Supporting claims and evidence are minimal.</td>
<td>Supporting claims and evidence are present but not fully developed or only a few points are considered.</td>
<td>Supporting claims and evidence are discussed and several points are considered.</td>
<td>Supporting claims and evidence are discussed at length and various points help reveal the complexity of the issue.</td>
</tr>
<tr>
<td><strong>Refutation</strong></td>
<td>No refutation is provided.</td>
<td>One type of counterclaims (i.e. objection[s]) is provided.</td>
<td>Two types of counterclaims (i.e. an objection and a rebuttal) are provided and help consider different sides of the issue.</td>
<td>More than two counterclaims (i.e. objections and rebuttals) are provided and help reveal the complexities of the issue.</td>
</tr>
<tr>
<td><strong>Mapping</strong></td>
<td>No mapping is provided or little effort is evident in the visual arrangement of the argument.</td>
<td>The visual arrangement of the parts of the argument is somewhat confusing and does not indicate always if the claims are used to confirm or refute the previous claims.</td>
<td>The visual arrangement of the parts of the argument facilitates understanding and evaluation of the argument. It is logically arranged, indicating clearly if the claims are used to confirm or refute the previous claims.</td>
<td>The visual arrangement of the parts of the argument is aesthetically pleasing and facilitates understanding and evaluation of the argument. It is logically arranged, indicating clearly if the claims are used to confirm or refute the previous claims.</td>
</tr>
<tr>
<td><strong>Logic</strong></td>
<td>Reasoning contains some faulty premises or illogical connections between claims (i.e. faulty inferences)</td>
<td>Reasoning contains some weak premises and/or some of the connections are not logically sound.</td>
<td>Reasoning mostly contains strong premises and the logical relationships between various claims are sound.</td>
<td>Reasoning contains strong premises and the logical relationships between various claims are sound, strengthening the epistemic force of the whole argument.</td>
</tr>
<tr>
<td><strong>Logical Connectors</strong></td>
<td>No logical connectors are used or some connectors are used incorrectly.</td>
<td>Only a few logical connectors are used.</td>
<td>Logical connectors as well as the syntactic progression of the argumentation are used to make apparent the argument logic.</td>
<td>Varied logical connectors along with the syntactic progression of the argumentation are used to help make apparent the argument logic.</td>
</tr>
</tbody>
</table>
French Literary Seminar

RESULTS

• Basic Argument Construction and Mapping Rubric

<table>
<thead>
<tr>
<th></th>
<th>Formulating a Position</th>
<th>Confirmation</th>
<th>Refutation</th>
<th>Mapping</th>
<th>Logic</th>
<th>Logical Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept Maps Satisfactory</td>
<td>87%</td>
<td>47%</td>
<td>33%</td>
<td>27%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>Argument Maps Satisfactory</td>
<td>86%</td>
<td>57%</td>
<td>43%</td>
<td>57%</td>
<td>57%</td>
<td>43%</td>
</tr>
<tr>
<td>Final Project Maps Satisfactory</td>
<td>56%</td>
<td>56%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Number of students = 9
Mind maps were easier to complete and were met with greater enthusiasm by students than argument maps.
  - 56% of students used mind maps for their final research project over 44% who used argument maps.

Proper concept maps were not produced by students.
  - Only 11% of maps were concept maps over 89% of mind maps.

Associative flow of mind maps lacks rigor and logical connections.
  - In concept/mind maps, 7% used logical connectors
  - In argument maps, 43% used logical connectors.
• Clarity of argumentation is mostly achieved in argument maps.
  • **Argument maps outperformed mind/ concept maps:**
    • 43% over 33% in refutation, 57% over 27% or 33% in clarity of visualizing of the argumentation, 57% over 7% or 33% in logical representation and 43% over 7% or 33% in the use of logical connectors.

• Use of color in mapping seems to assist students to group ideas that are related. However, it does not make student reflect on the nature of inferences or links between ideas.
  • 52% used color in their maps (16 maps out of 31 total maps)
## Critical Thinking Skills

1. Visual thinking (use of maps or any visual representation of...)
   - 5.56

2. Concept mapping was a helpful tool to further develop my... 
   - 5.56

3. Argument mapping was a helpful tool to further develop my... 
   - 5.89

## Written Communication Skills

4. Visual thinking (use of maps or any visual representation of...)
   - 5.56

5. Concept mapping was a helpful tool to further develop my oral... 
   - 5.67

6. Argument mapping was a helpful tool to further develop my oral... 
   - 5.78

## Oral Communication Skills

7. Visual thinking (use of maps or any visual representation of...)
   - 6.11

8. Concept mapping was a helpful tool to further develop my... 
   - 6.33

9. Argument mapping was a helpful tool to further develop my... 
   - 6.33

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**Student Feedback Survey - Weighted Averages**

Feedback questionnaire used the Likert scale (1-7), 7 indicating strongly agree. Number of students = 9
French Literary Seminar

RESULTS

• Argument maps were judged by students as more difficult and were less well-produced. However, in the qualitative portion of the student feedback survey, they reported that they would use argument maps to structure their arguments in the future.
  • 79% (7 out of 9 students) felt that argument maps were the most helpful to develop critical thinking skills (SFS).
  • **Student Comments**: “[Argument maps] seem to be more in depth, and challenged my opinions”; “[They] make you think about ideas from multiple perspectives. Concept maps, it’s kind of just your perspective.”
  • “[In] classes where there is too much data & too many arguments to consider, I already find myself referencing back to the theories we learnt here.”
“EMPLOYABILITY SKILLS - In addition to specific job-related training, Mid-State has identified a set of employability skills which are transferable and go beyond the content of a specific course.

- Act with Integrity
- Communicate Effectively
- **Demonstrate Effective Critical and Creative Thinking**
- Demonstrate Global Social Awareness”

http://www.mstc.edu/employability-skills

- learner uses a structured problem-solving approach
- learner demonstrates open-mindedness
- learner organizes information
- learner works successfully in a climate of ambiguity and change
- learner applies previously acquired knowledge to new tasks
Critical and Creative Thinking

• Focus of the 2019-2020 academic year
• College-wide initiative
  • Assessment in multiple programs
  • Building a common rubric to assess critical thinking
  • Argument mapping as common strategy
Critical and Creative Thinking

• Practicing simple maps with MindMup each week
  • Reason-conclusion
  • Independent reasons
  • Dependent reasons

• Conducting a debate through Truthmapping
  • Assigning a current issue to research and argue for or against
  • Critiques and rebuttals
Used argument mapping to represent the three theoretical approaches of sociology.
Structural Functional Approach

Society is a system of interrelated parts that is relatively stable.

Social Structures Shape our lives.

Social Functions tie people together and keep society going.

Manifest Functions: Recognized and intended consequences of any social pattern.

Latent Functions: Unrecognized and unintended consequences of any social pattern.

Social Dysfunction: Any social pattern that may disrupt the operation of society.

Focus on stability at the expense of conflict ignores inequalities based on social class, race, gender.
Symbolic Interaction

Society is the product of everyday interactions of individuals.

Society is the reality that people construct for themselves as they interact with one another.

We live in a world of symbols.

As we define our surroundings we create reality.

Social Exchange Analysis: interaction is guided by what each person stands to gain or lose from others.

Dramaturgical Analysis: we resemble actors playing a role.

Risk overlooking widespread influence of culture, as well as factors such as class, gender, and race.

Mead: Personalities develop as a result of social experiences.
Sociology

Social Conflict Approach

Society is an arena of inequality that generates conflict and change.

People who benefit from current social structures try to protect privileges while disadvantaged try to gain more for themselves.

Pursues social change: Political

Cannot claim scientific objectivity

All theoretical approaches have political consequences

Race, class, gender, ethnicity are linked to inequality in terms of money, power, and social prestige.

Gender Conflict Theory

Race Conflict Theory

Feminism

Any social pattern benefits some while hurting others.

Ignores how shared values and interdependence can unify members of society.
• Argument mapping works well in any class that deals with theory.
• The theory is the conclusion and you can break down the reasoning behind the theory by mapping it.
• This is helpful for students who have a hard time understanding the reasons behind a theory.
Argument mapping can be used in Adult Basic Education to help students who have trouble deriving meaning from a text.
Upon completion, participants will be able to identify some ways to use graphical representations of reasoning at their institution.
“I'm confident that my house will sell within six months. For one thing, my asking price is within $10,000 of what I paid for the house so it's certainly priced reasonably and reasonably priced houses always sell quickly. For another thing, my house is in really good shape. My sister-in-law thinks that the siding needs to be replaced, but that's not true. The siding is designed to look distressed. Finally, and maybe best of all, my house is on a river. Of course, my sister-in-law says this doesn't mean that my house will sell quickly. 'Lots of people are worried about flooding,' she says. But how can that be? People buy waterfront property all the time.'

Try it Out

• What are the important assertions?
• How are these assertions related to each other?
My house will sell within six months.

My house is priced reasonably.
Reasonably priced houses always sell quickly.
My asking price is within $10,000 of what I paid for the house.

My house is in good shape.
The siding needs to be replaced.
The siding is designed to look distressed.

My house is on a river.
Lots of people are worried about flooding.
People buy waterfront property all the time.
Graphical Representations of Reasoning at Your Institution

- Instructors
  - Humanities?
  - Sciences?
  - Professional Programs?
  - Other?

- Assessment Professionals
  - Opportunities?
  - Challenges?

- Administrators
  - Opportunities?
  - Challenges?
INVITATION

We’d love to hear from you!
REFERENCES


• bCisive https://www.bcisiveonline.com/
• MindMup https://www.mindmup.com/tutorials/argument-visualization.html?orig=/
• Rationale https://www.rationaleonline.com/
• Truthmapping https://www.truthmapping.com/#cat=3