Teaching Research Methods in a First-Year Critical Thinking Seminar

Cassandra Delgado-Reyes, Ph.D.
Annual Conference on the First Year Experience
San Antonio, Texas
February 2012
Overview

• Background
• Critical Thinking and Research Methods
  ▫ Sample Activities
• Independent Inquiry
  ▫ Meeting of the Minds project
Background: Why?

Introduction to Intellectual Expectations

Introduction to Educated Culture

Introduction to Empowered Citizenship

Why Critical Thinking?

Increase interest/retention in STEM (Russell, et al., 2007)

Mechanism to continue: Freshman Research Initiative (fri.cns.utexas.edu)

High diversity in TIP Scholars
Background: Our Program

- **Texas Interdisciplinary Plan (TIP) Scholars**
  - First-year program – 325 students/year
  - 150 Natural Science, 150 Liberal Arts, 25 Education

- TIP *critical thinking seminar* fulfills required freshman seminar course
  - Large lecture - 1 contact hour/wk, entire cohort
  - Small seminars - 3 contact hours/wk, 24 person class-size
Background: Our Course

Course Objectives

• Critically evaluate beliefs, arguments, and information.
  ▫ Self and others

• Information literacy in developing and evaluating arguments.

• College-level consideration and articulation of complex ideas.

• Fair-mindedness in seeking knowledge and understanding.

RM Objectives

...plus

• Understand how science works.

• Foster interest in research.
Critical Thinking: Our Approach

- Self-Awareness
- Worldviews
- Cognitive Development

**Identify:** Nature of the Thinker

**Define:** Critical Thinking
- Traits of a Critical Thinker
- Standards
- Skills

- Identify
- Analyze
- Create

**Apply:** Argument
Critical Thinking: Our Tools

- Perry’s Cognitive Theory of Student Development
  - Dualism, Relativism, Commitment (W. G. Perry, Jr., 1997)
  - Garden of Eden, Everything Goes, Critical Thinking (Chaffee, 2004)
- Center of our worldview: “-centrisms”
  - egocentrism, ethnocentrism, sociocentrism (Ruggiero, 2004; Paul & Elder, 2001)
- Personal Lenses – permission and awareness is first step
Activity: Perspectives Awareness
(Albatross, Beyond Experience, 1977)

• Worldview/Personal Lens discussion prompt
  ▫ Skit to start discussion about influences inherent in our thinking.
Critical Thinking: Our Tools

- Critical Thinking (Halpern, 2003)
  - Talks about CT in terms of published studies

- Traits of the Disciplined Mind (Paul and Elder, 2001)
  - Provides vocabulary to describe abstract traits of thinking
    - Intellectual Humility : Arrogance
    - Intellectual Perseverance : Laziness

- Intellectual Standards (Paul and Elder, 2001)
  - Applied to argument analysis
    - Fairness, Breadth, Accuracy, etc.

Nature of the Thinker

Critical Thinker

Argument

Application
Activity: 12 Angry Men movie

- Assignment: Identify and describe traits of thinking
- In class: Discuss and clarify
Critical Thinking: Our Tools

- **Toulmin Model** (White and Billings, 2008)
  - Framework to analyze arguments
  - Informal – give names to components of argument for evaluation

- **Claim** – persuasive point
- **Grounds/Data** – support
- **Qualifiers** – exceptions
- **Warrants** – assumptions about support quality
- **Appeals** – logos, ethos, pathos (Lunsford and Ruszkiewicz, 2007)
Activity: Take-A-Stand

Students move to sides of the room to “take a stand” for their position on a controversial question and take turns supporting their position and evaluating other positions.

Can be used to practice:

- Outlining arguments (their own and others’)
- Fair-mindedness in considering different perspectives
- Evaluating different types of appeals (not necessarily support)
- Practice changing position due to sound argumentation
## Research Methods: Argument

<table>
<thead>
<tr>
<th>Nature of the Thinker</th>
<th>Argument Term</th>
<th>Scientific Term</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Argument</strong></td>
<td>Claim</td>
<td>Hypothesis</td>
</tr>
<tr>
<td></td>
<td>Support</td>
<td>Primary Data (Study) Secondary Data (Lit Review)</td>
</tr>
<tr>
<td></td>
<td>Warrants/Assumptions</td>
<td>Operational Definitions Lit Review Evidence**</td>
</tr>
<tr>
<td></td>
<td>Qualifiers</td>
<td>Controls Sample Selection</td>
</tr>
</tbody>
</table>

**Build an argument, not use arguments already made.**
Activity: Superstition Science
(Hoefnagels and Rippel, 2003)

• Students design experiments to test superstitions

Low stakes practice in identifying:
• Hypotheses
• Variables
• Measurable outcomes
• Operational definitions
• Confounding factors
• Controls
Critical Thinking: Our Tools

In class
- Activities to introduce and clarify concept
- Model identification and use of concept
  - Personally relevant, significant examples
  - Popular media, major decisions, student generated topics

Assignments
- Written reflections on large lectures, analyzing thought process
  - Emotional and intellectual reactions

Meeting of the Minds Project
- Controversial issues or Scientific arguments
- Collaborative learning
Activity: Argument Analysis

• **Media**
  ▫ Health claims
  ▫ News articles
  ▫ Advertisements
  ▫ Opinion/Editorial pieces

• **Scholarly science**
  • Abstracts
  • *Lies, Damned Lies, and Science* (Seethaler, 2009)
Activity: Abstracts as Arguments

Abstracts act as condensed arguments

- Identify:
  - Claim, Support, Assumptions, Qualifier
  - Variables, Controls, Operational Definitions

Choose student-relevant topics

- Sleep, caffeine
- Factors affecting academic performance
- Weight loss, nutrition, functional foods

Introduces electronic databases and how to read scientific literature
Research Project: Meeting of the Minds

Term-long project conducted in small teams

- **Lab based** inquiry – Salivary $\alpha$-amylase
  - Materials
    - Spectrophotometer
    - Lugol’s iodine
    - Starch solution

- **“Field” based** inquiry – flexible
  - Usually surveys, but can be experiments
  - Student provide own basic materials
  - Safe, legal, ethical
# Research Project: Objectives

<table>
<thead>
<tr>
<th>Process</th>
<th>Model &amp; Practice</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative idea generation</td>
<td>In-class mind mapping of research questions, alternate hypotheses</td>
<td>Study proposal (research question, hypotheses generation)</td>
</tr>
<tr>
<td>Evaluating and using the literature</td>
<td>Argument identification in abstracts, media</td>
<td>Study proposal (literature review)</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>Levels of measurement (Wharrad, 2003) Data presentations</td>
<td>Experimental design/methods/results</td>
</tr>
<tr>
<td>Peer Review</td>
<td>Take A Stand</td>
<td>Discussion board threads Peer grading</td>
</tr>
</tbody>
</table>
Research Project: Timeline

Product

Project Overview

Research Q Proposal

Peer Review

Team Brainstorm

Literature Review

Study Proposal

Peer Review

Data Collection

Data Analysis

Presentation

Research Report

Peer Review

Poster Session

Process

Data Analysis

Research Report

Peer Review

Poster Session

Research Project: Timeline

Product

Project Overview

Research Q Proposal

Peer Review

Team Brainstorm

Literature Review

Study Proposal

Peer Review

Data Collection

Data Analysis

Presentation

Research Report

Peer Review

Poster Session

Process

Data Analysis

Research Report

Peer Review

Poster Session
## Comparative Research Methods

<table>
<thead>
<tr>
<th>Point of comparison</th>
<th>Natural Sciences</th>
<th>Social Sciences</th>
<th>Humanities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>Understand how nature works</td>
<td>Understand how humans work</td>
<td>Understand the human experience</td>
</tr>
<tr>
<td><strong>Most powerful tool(s)</strong></td>
<td>Peer review, Repeatability</td>
<td>Statistical significance</td>
<td>Open discourse of meaning</td>
</tr>
<tr>
<td><strong>Significance</strong></td>
<td>Great discussion topics!</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Ethics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Intellectual value</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Societal value</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Activity: Humanities Research Proposal

Students think like humanists to create a research question and propose evidence for a theory based on humanistic research objectives.

They are required to support their argument using artifact evidence from campus museums, exhibits, or collections.
In Summary:
Arguments used to practice and discuss critical thinking
Thank you

Included in your handouts:

• Works Cited
• Chapter descriptions from Seethaler book
• Research Project Overview

Cassandra Delgado-Reyes
Dr.D-R@austin.utexas.edu
The University of Texas at Austin
Works Cited


Lies, Damned Lies, and Science (Seethaler, 2009) – Chapter descriptions

1. Understanding how science happens and why scientists sometimes disagree.
2. Identify those who hold stake in an issue and what their positions are.
3. Elucidate all the pros and cons of a decision.
4. Place alternatives in appropriate context to evaluate trade-offs.
5. Distinguish between cause and coincidence.
6. Recognize how broadly conclusions from a study may be applied.
7. See through the number jumble.
8. Discern the relationships between science and policy.
9. Get past the ploys designed to simply bypass logic.
10. Know how to seek information to gain a balanced perspective.
MEETING OF THE MINDS (MotM) – RESEARCH PROJECT OVERVIEW

<table>
<thead>
<tr>
<th>Week</th>
<th>Project Stages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Explore MotM Project A</td>
</tr>
<tr>
<td>2</td>
<td>MotM Quiz Due B</td>
</tr>
<tr>
<td>3</td>
<td>Research Questions and Rationale C</td>
</tr>
<tr>
<td>4</td>
<td>Information Literacy Workshop - Keyword Log Due D</td>
</tr>
<tr>
<td>5</td>
<td>Study Proposal Due E</td>
</tr>
<tr>
<td>6</td>
<td>(Lab and Safety Training if needed)</td>
</tr>
<tr>
<td>7</td>
<td>(Lab and Safety Training if needed)</td>
</tr>
<tr>
<td>8</td>
<td>(Data Collection and Analysis)</td>
</tr>
<tr>
<td>9</td>
<td>(Data Collection and Analysis)</td>
</tr>
<tr>
<td>10</td>
<td>Data Presentations F (Data Collection and Analysis)</td>
</tr>
<tr>
<td>11</td>
<td>Research Report Introduction Due G (Data Analysis and Reporting)</td>
</tr>
<tr>
<td>12</td>
<td>(Data Analysis and Reporting)</td>
</tr>
<tr>
<td>13</td>
<td>Final Research Report Due H</td>
</tr>
<tr>
<td>14 (TG)</td>
<td>Posters due for printing I</td>
</tr>
<tr>
<td>15</td>
<td>Poster Session J Final Self and Peer Evaluation K</td>
</tr>
</tbody>
</table>

A. Research study parameters introduced. Individual and team brainstorming of research questions and rationale begin.
B. The Quiz will demonstrate your understanding of the project instructions.
C. In order to help narrow down your research question, your team will post three to four ideas for research questions for your study, including rationale, on the Blackboard Discussion Board for instructor and peer review. You will also be individually responsible for reviewing another team's post for feasibility and logic.
D. Based on reviews on your proposed research questions (from step B), your team will decide on your top two choices for research questions and come with ideas, search terms, and notes on what information you will need to build hypotheses, background rationale, and methods so that you have a structured plan during this in-class workshop. Bring your laptops!
E. A more in-depth Study Proposal on your final research question will be posted on Blackboard’s Discussion Board for peer review. You will also be responsible for reviewing another team’s Proposal for quality, experimental design, and work plan.
F. You will receive a data set and experiment notes on a sample experiment (independent of your study) to practice creating and presenting graphical summaries of data. Your team will present your sample study and its data in a brief oral presentation, explaining the method and rationale behind the graphical summaries you create from the sample data.
G. Your team will submit a draft of your cited Introduction section of your Research Report, including discussion of the research question, potential hypotheses, background literature that supports your primary hypothesis, and basic experimental approach. It should be descriptive as well as persuasive.
H. Final team written research report is submitted.
I. Electronic PowerPoint versions of research posters are due via email on Monday
J. On Tuesday, teams will present research during in-class poster session.
K. Individual Peer Evaluations of team work due.