

Demonstration and dialectical arguments: Guiding undergraduate student writing about cancer biology

Alison Wallace¹, Meena M. Balgopal², Anne Marie Casper², Paul J. Laybourn², and Ellen Brisch¹
¹Minnesota State University Moorhead, Moorhead, MN ²Colorado State University, Fort Collins, CO

Introduction

Background: Writing-to-learn (WTL) enables students to:

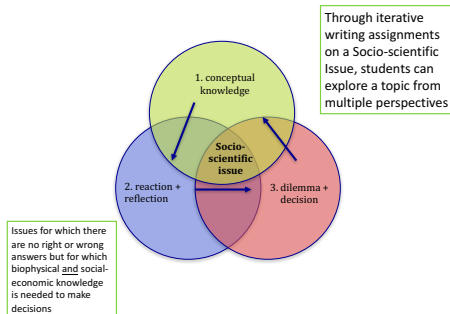
- Engage in an iterative strategy that allows them to revise ideas
- Draw on different funds of knowledge (personal and academic) to support claims
- Describe decisions after weighing trade-offs
- Use informal reasoning that integrates ethical and cognitive perspectives

Research Question: How much guidance do students need as they draw from multiple data sources to make sense of complex scientific topics?

Purpose of the Study: To compare the rhetorical strategies used by students randomly selected from two sections of undergraduate cell biology that participated in WTL interventions but received different levels of guidance.

Theoretical Framework

Cognitive-Affective-Behavior WTL (Authors 2009)



Aristotelian Rhetorical Arguments

Demonstration arguments are conclusions that are supported by premises that are assumptions or assertions. (Explanatory)

Dialectical arguments present conclusions that are supported by premises that are not classified as true or primary; rather, they are accepted or not accepted. The premises, are therefore, questioned by the reader as they evaluate the logic of the argument. (Persuasive)

Methods

Context: research university

Participants: biochemistry majors in introductory cell biology

SSI: Cancer Treatment (specifically, anti-cancer drugs)

Curriculum: 3 WTL-WTC assignments about cancer treatment; *New York Times* and *Science News* articles

Treatments: Table 1: Writing intervention treatment descriptions for two separate semesters of introductory cell biology

Condition	Intervention
B	Treatment: lots of writing (3 WTC essays with weekly WTL assignments over 15-week semester)
C	Treatment: some writing (3 WTC essays-one every five weeks without WTL assignments)

First (of three) cycles of writing:

- WTL Prompt 1** - *Imagine that a friend or relative of yours was diagnosed with cancer and was considering treatment with anti-cancer drugs. Think about how you might explain to them what you know about anti-cancer drugs and how they work.* (Condition B)
- WTL Prompt 2** - *Consider your personal connections and reactions to what you know about anticancer drugs and their role in the treatment plan for this person.* (Condition B)
- WTL Prompt 3** - *What actions might you take as you consider this imaginary situation of your friend or relative going through cancer treatment?* (Condition B)
- WTC ESSAY ASSIGNMENT:** *Use this information to construct a short essay about the decisions you will make (i.e. what will you do) regarding anti-cancer drug treatment.* (Conditions B & C)

Additional Variables: Minority Status, College Generational Status, Gender, Course Grade

Analysis: All minority and first gen student essays were analyzed. A subset of the remainder of the classes were selected at random. Essays were selected for final analysis if they contained an obvious conclusion related to the prompt, and personal, scientific, or a combination of personal and scientific evidence supporting this conclusion. They were then classified using the Aristotelian dichotomy of knowledge producing rhetor: *demonstrations* or *dialectical arguments* (Prelli, 1989), through weekly meetings of prolonged engagement establishing intra-rater coding consistency.

Findings

Demonstrative argument example:

"You have many options you can do if you are diagnosed by cancer. As in the case of a benign (tumor), surgery or radiation are the preferred methods of treating growths because at this stage it has a well-defined location and it is easy to see and remove it. However if the cancer cell spread or conquer other parts of the body, anti-cancer drugs are the best option you have."

Dialectical argument example:

"That both options have significant cons and very little pros makes choosing one over the other difficult. But I would suggest first seeking treatments that have a chance of working, such as chemotherapy or some other well known anti-cancer treatment. Doing so would slow down the spread of cancer, and would let the person live longer than without treatment. I would suggest trials as a last resort, when traditional treatments are failing. The chances of success then would be slim, but nonetheless, there is the chance that the trials would improve the status of the cancer patient."

Findings

Which factors result in more dialectical arguments in the essays?

Non-significant comparisons:

- ✓ Lots of writing (WTL+WTC) vs. little writing (WTC)
- ✓ Male vs. Female
- ✓ First Generation vs. Non-First Generation

Minority students? Minority students appear to *perhaps* write more dialectical arguments than non-minority students, regardless of treatments (although this is non-significant; Fisher's Exact Test, $p < 0.3$):

Table 2: Proportion of student essays categorized as dialectical

	WTC	WTL + WTC
Minority	0.60 (n=10)	0.60 (n=10)
Non-Minority	0.43 (n = 7)	0.45 (n=11)

Discussions & Implications

Preliminary Conclusions:

- Approximately half of the students incorporated dialectical arguments in their essays, regardless of the writing intervention.
- The second and third sets of essays have yet to be (re)analyzed (a very cursory analysis was done summer 2016 with a limited coding rubric that has been revised since then). Perhaps students will increase their use of dialectical arguments with practice?
- An increased proportion of minority students writing dialectical arguments vs. non-minority students is intriguing. Sample sizes in this study are limited, but future studies could further investigate this pattern.



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For complete conference proceeding: <http://writingtolearnscience-balgopal.weebly.com/papers.html>