

# **POWERFUL HOMEWORK, ENGAGED CLASS-TIME: Designing Critical Thinking Problems that Promote Deep Learning while Teaching Disciplinary Inquiry and Argument**

University of Kansas

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**Powerful Homework:** “. . . I find it fascinating that in faculty discussions about curriculum and course structure . . . 90 percent of our discussion focuses on what material and ideas to cover in class. We pay far less attention to the details of homework assignments. So it is good for faculty to learn from students that the design of homework, and how we ask students to do that homework, matters a lot . . .” (51).

Richard J. Light. (2001). *Making the Most of College: Students Speak Their Minds*. Cambridge: Harvard U. Press

**One-minute freewrite:** If you could change the way students study for one of your courses, what changes would you hope for and why?

## **Overview and Principles**

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*“[Highly effective teachers confront students with] intriguing, beautiful, or important problems, authentic tasks that will challenge them to grapple with ideas, rethink their assumptions, and examine their mental models of reality” (p.18).*

Ken Bain. (2004). *What the Best College Teachers Do*. Cambridge: Harvard University Press

*“It seems to me, then, that the way to help people become better writers is not to tell them that they must first learn the rules of grammar, that they must develop a four-part outline, that they must consult the experts and collect all the useful information. These things may have their place. But none of them is as crucial as having a good, interesting question.”*

Rodney Kilcup, Historian, from a 1980s Puget Sound Writing Project Newsletter

## THINKING ABOUT STUDENTS' STUDYING PROCESSES: SCENARIOS FOR DISCUSSION

### Scenario [First-Year Gen Ed Course]

Imagine that you are teaching an "Introduction to Psychology" course, primarily to first year students early in their college careers. It is Monday. For Wednesday's class you want them to read the textbook chapter explaining some of the important modern schools of psychology. How might students' studying and thinking processes differ depending on the way you give the homework task?

1. For Wednesday, read Chapter 2.
2. For Wednesday, read Chapter 2 and be prepared for a quiz.
3. For Wednesday, read Chapter 2 and then write a one page thinking piece that addresses the following question: *Suppose you are a parent who goes to a child psychologist for advice on how to get your 10 year old child to practice the piano. It seems the child rushes out of the room screaming every time you insist he practices. What different advice would you get if the child psychologist were a behaviorist, a psychoanalyst, or a humanistic psychologist?* Come to class with your completed thinking piece and be prepared to share your ideas with classmates.

**Discussion question:** If you decided to try out Strategy 3, don't worry for now what you would do with all those thinking pieces. We'll deal with that question later. For now, just focus on how each of these strategies might alter the way students studied. *Please explore with colleagues at your table how students would read and study differently depending on how the homework task was assigned.*

### Suggested further reading on "powerful homework"

- Roberts, J. C. & Roberts, K. A. (2008). Deep reading, cost/benefit, and the construction of meaning: Enhancing reading comprehension and deep learning in sociology courses. *Teaching Sociology*, 36, 125-140.
- Yamane, D. (2006). Course preparation assignments: A strategy for creating discussion-based courses. *Teaching Sociology*, 34, 236-248.

## GENERAL PRINCIPLES FOR ENCOURAGING DEEP VERSUS SURFACE LEARNING

The term ‘deep learning’ first came into common usage in the 1980s when Noel Entwistle and colleagues published research that distinguished between deep and surface learning. Their distinction is outlined below.

### **Deep approach**

**Intention: to understand ideas for yourself**

- Relating ideas to previous knowledge and experience
- Looking for patterns and underlying principles
- Checking evidence and relating it to conclusions
- Examining logic and argument cautiously and critically
- Becoming actively interested in course content

### **Surface approach**

**Intention: to cope with course requirements**

- Studying without reflecting on purpose or strategy
- Treating the course as unrelated bits of knowledge
- Memorizing facts and procedures routinely
- Finding difficulty in making sense of new ideas presented
- Feeling undue pressure and worry about work

[This summary comes from Sims, Emma. (2006). *Deep learning: A new shape for schooling?*  
Retrieved from Specialist Schools and Academies Trust website: [http:// www.ssat-inet.net](http://www.ssat-inet.net)]

### **1. Establish your course goals (often stated in syllabus as learning outcomes)**

- subject matter goals—the new knowledge (facts, concepts, theories methods) that you want students to learn
- critical thinking or disciplinary thinking goals—new ways that you want students to see or think: disciplinary processes of inquiry, critical reading, analysis, and argument

### **2. Design critical thinking problems connected to your course goals.**

- Problems should cause students to use subject matter knowledge while promoting disciplinary ways of thinking, analyzing, and arguing
- Highest level of critical thinking typically comes from “messy,” “ill-structured,” or open-ended problems with no algorithmically attained “right answer”—problems that lead to a claim with supporting arguments.

### **3. Develop a repertoire of ways to give critical thinking problems to students**

- Questions for in-class freewrites and subsequent in-class discussions
- Tasks for small-group problem solving or debates
- Thought provokers for out-of-class exploratory writing (“thinking pieces”; posts to course discussion boards; journal or blog entries; other kinds of informal, non-graded writing)
- Short (2-3 page) writing assignments or very short (less-than-a-page) microtheme assignments.
- Longer, formal writing assignments often requiring research
- Practice essay exam questions (or actual essay exam questions)

### **4. Think of homework assignments as a crucial part of course design**

- “Reverse engineer” your course by designing the final assignment first (“backward design”)
- Create earlier assignments that develop the skills needed for the final assignment (sometimes called “scaffolding assignments”)
- Consider adding informal low-stakes writing to help students explore ideas and promote learning

## SUGGESTED WAYS FOR USING WRITE-TO-LEARN TASKS TO CREATE POWERFUL HOMEWORK

*Ask students to explain a course concept to a new learner (requires students to understand the concept at a level deeper than memory)*

- Explain to your English major friend that the word “significance” has a different meaning to statisticians than it does to the average person.
- Explain to a grade school child who has just been diagnosed with Type 1 diabetes what is meant by the glycemic index of foods.

*Give students a thesis to support or attack (teaches disciplinary use of evidence to make arguments)*

- The overriding religious view expressed in Hamlet is (is not) a stable medieval Catholicism.
- Prescribing Ritalin and other psychotropic medications is (is not) an appropriate treatment for behavioral problems of children.

*Give students a problematic question (teaches students to propose and support their own thesis)*

- What should Project Manager Hisako Hirai propose to her supervisor in response to the problems that have cropped up in Week Three? Role-playing Ms. Hirai, write a memo to your supervisor presenting and justifying your recommendations [part of a business management case]
- Now that we have discussed various design approaches for the circumference-mounted radiator fan, what do you recommend as the most optimal solution? Write an email message to the other members of your design team arguing for the approach you think your team should take.

*Give students a data set to analyze (teaches students to use quantitative data to make arguments)*

- To what extent do the attached economic data support the hypothesis "Social service spending is inversely related to economic growth"? First create a scattergram as a visual test of the hypothesis. Then create a verbal argument analyzing whether the data support the hypothesis. (Courtesy of Dr. Bridget Hiedemann, Economics, Seattle U)
- Your friend and you are looking over the attached table that shows the most recent mean and median income of U.S. households by age categories. You notice that for retired households, the mean income is substantially higher than the median income. Your friend, looking at the mean income, says that retired people in the US are surprisingly well off. You want to argue that the median income tells a quite different story, but then your friend has to rush off for a meeting. Send your friend an email message about one screen in length that explains the difference between “mean income” and “median income” and that argues that the income status of retired people is not so rosy if we focus on median rather than mean income.

*Give students a challenging reading to summarize and analyze (teaches students to summarize and speak back to difficult texts)*

- Write a 200-250 word summary of Kenneth Galbraith’s paper, “The Theory of Countervailing Power.” Your summary should accurately convey the content of the paper while being comprehensive and balanced.
- Should PomWonderful pomegranate juice be considered a food, a nutritional supplement, or a drug? Summarize the Federal Trade Commission’s argument against Pom Wonderful’s advertising campaign. Then assume that you are spokesperson for Pom Wonderful. Write a one-page reply that attempts to rebut the government’s argument.

*Give students a peer-reviewed article to wrestle with (teaches students disciplinary ways of entering into conversation with other scholars)*

- Read the assigned paper by Baron-Cohen et al. on fetal exposure to testosterone. To what extent do you think this paper supports or undermines the nature theory of gender identity?
- In the introduction to a conference paper, you want to show that critics disagree on how to regard Caliban in *The Tempest*. Using the two scholarly articles on Caliban that I have posted on our course site, write the section of your introduction that will show how these two scholars disagree on their reading of Caliban. Limit yourself to 350 words.

*Have students write dialogs between real or fictitious characters with different points of view (teaches students to negotiate intellectual ambiguity and complexity)*

- Recently, John Locke and Auguste Comte were strolling through downtown Seattle and came upon the Occupy Seattle protestors demonstrating in Westlake Park. Naturally, this sight stirred intense conversation between them. Drawing upon what you know of their distinct social philosophies, write a dialogue between them that reflects the conversation they would have had about the protest and its value and consequence for society.

(Courtesy of Dr. Mark Cohan, Sociology, Seattle U)

[For a humorous dialog on the value of dialogs as write-to-learn tasks, see Chris M. Anson, (2011). "My Dinner with Calais," *Pedagogy: Critical Approaches to Teaching Literature, Language, Composition, and Culture*, 11(3), 578-590.]

*Let students develop their own questions (teaches question-posing strategies in your discipline)*

- Now that we have practiced asking interpretive questions about poems, consider Yeats' "Among School Children." Propose your own interpretive question about this poem, and then write an explication of the poem that tries to answer your question.
- Pose an empirical research question of the form "What is the effect of X on Y?" and then explore the way that you might design an experiment to try to answer this question.

*Ask generic write-to-learn questions (promotes reflection and metacognition)*

- What confused you in today's class or today's readings?
- How does your personal experience relate to what you studied today?
- What effect is this course having on your personal life, your beliefs, your values, your previous understanding of things?
- How does what we have been studying recently relate to your other courses or to other parts of this course?

### Examples of Short Formal Assignments (Microthemes)

**Physics:** Suppose that you are Dr. Science, the question-and-answer person for a popular magazine called Practical Science. Compose your best answer to the following letter

Dear Dr. Science:

Please help me settle this argument I am having with a friend. We were watching a baseball game several weeks ago when the batter hit a high pop-up straight over the catcher's head. When it finally came down, the catcher caught it standing on home plate. My friend told me that when the ball stopped in midair just before it started back down, its velocity was zero, but its acceleration was not zero. I told my friend that he was stupid. If something isn't moving at all, how could it have any acceleration? Ever since then he has been making a big deal out of this and insists that I don't have the brains of A housefly. I don't think we can be buddies again until we settle this argument. We checked some physics books, but they weren't very clear. We agreed that I would write to you and let you settle the argument. But, Dr. Science, don't just tell us the answer. You've got to explain it so we both understand because my friend is really stubborn. He wouldn't even trust Einstein unless Einstein presented a clear explanation.

**Environmental Studies:** In the attached op-ed piece, conservative columnist George F. Will celebrates Americans' "stunning abundance of fossil fuels—beyond their two centuries supply of coal." Will cites vast reserves in the Canadian tar sands as well as reserves of natural gas recoverable through fracking. Drawing on the BP energy tables we have studied in class, write a letter to the editor (no more than 300 words) that begins with either of the two following thesis-statement options: "George Will's claim that we have a 'stunning abundance of fossil fuels' (*Seattle Times*, Jan. 1, 2012) is (a) dangerously optimistic or (b) well supported by existing data."

**Workshop task:** Return now to the notes you made in the opening one-minute freewrite about how you would like to change your students' study habits. What ideas from the workshop so far might help your students deepen their learning or come to class better prepared or more engaged. If they make sense for your course, try using one or more of the suggestions on pages 4 and 5, but feel free to create whatever might work for your course. Be ready to share ideas with colleagues at your table.

## CASE STUDY FROM INTERMEDIATE MICROECONOMICS: TEACHING NEW MAJORS STUDENTS TO “THINK LIKE ECONOMISTS”

*Assignments used with permission from Dr. Gareth Green, Department of Economics, Seattle University*

### Green’s Scaffolding Plan (5 credit quarter-system course)

Throughout Course (algorithmic problems)	Beginning about 3 <sup>rd</sup> week of course (bi-weekly “messy-lite” problems)	Near end of course (“full-messy” policy memo)
Algorithmic problems from textbook 	Guided policy problems for homework and class discussion 	Two-page policy recommendation memo

#### Typical Algorithmic Problem from Textbook

“Calculate the own- and cross-price elasticities of demand for turkey based on the following demand curve,  $Q = 23 - 2p_T + 1.5p_C$ . The price of turkey is \$2.50 per pound, the price of chicken is \$2 per pound, and the quantity of turkey is 21 thousand tons per year.”

[What students don’t ask: Where do these figures come from? What theory or model requires this demand curve? Who cares?]

#### “Messy-Lite”: Example of Green’s “Guided Policy Problems” for Homework and Class Discussion

[Assigns students to read a newspaper article.] As the article states, the economic downturn has hit new car dealers especially hard. The article notes dealers have seen a 36% decrease in sales even though they have reduced prices by an average of 15%. a) Explain and draw a graph indicating how the market for new cars has changed. b) What is the implied own-price elasticity of supply? c) What is the monthly supply curve if the new average price of cars is \$28,000 and there are approximately 445,000 sold per month? d) What is the monthly demand curve if the own-price elasticity of demand for cars is -1.5? The article mentions that the federal government has decided to enact a program to boost car sales, the Car Allowance Rebate System (CARS). e) What would be the new price to consumers and quantity sold if the government gave a subsidy of  $s = \$2,979$  per car? f) What is the cost of the subsidy, the increased producer and consumer surplus, and the deadweight loss and what does each of these represent? g) Who benefits and loses from the CARS policy? h) How can the government justify implementing the subsidy policy with respect to efficiency and equity?

#### Green’s analysis of kinds of disciplinary thinking required in the above contextualized homework problem:

- (1) basic economic reasoning (part a),
- (2) basic calculations (parts b – d),
- (3) real-world application (parts e and f), and
- (4) interpreting and evaluating results from competing perspectives (part g and h).

## “Full-Messy”: Green’s Formal Writing Assignment: A Two-Page Policy Recommendation Memo

**Background:** You take an internship with the Seattle Department of Transportation (SDOT) as a research economist to help inform Elizabeth Canon, the director of SDOT, on the implications of Seattle’s Community Parking Program. Like most cities, Seattle is dealing with large budget deficits, and city council members are interested in finding new sources of revenue. One option under consideration is to significantly raise parking meters fees.

**Your Task:** Canon has asked you to write a two page memo on whether to increase parking meter fees. The memo will need to summarize the pros and cons of your recommended position, giving both supporting and alternative views. Fortunately, another intern (who has since been let go for not following directions) has performed the background research and found the sources given below. You need to review these sources, make calculations regarding the fee increase and potential revenue, determine your position, write a two page memo, and develop a graph that helps support your position. Not all pros and cons are quantifiable. It is important that you give quantitative and qualitative information so Canon can justify her position. There are public organizations and city council members on both sides of this issue, so it is imperative that your work is complete so Canon is well prepared.

**Format:** The standard memo format that Canon prefers is:

1. A paragraph orienting Canon to the purpose of your memo and summarizing your recommended position
2. Bullet points giving reasons in support of your recommendation based on your analysis, calculations, and relevant information from the sources provided
3. Bullet points giving reasons opposing your recommendation
4. A graph that you must develop to support your own position. The graph should be referred to in the bullet points. (Canon loves to show graphs to the media so clarity is critical)
5. A technical appendix with supporting calculations that are clearly described
6. Canon wants to know which sources you use, which you do not use, and why; so you will need to include an annotated bibliography.

**Note:** Canon, who is not an economist, is EXTREMELY busy. All writing has to be clear, concise, and accurate. (Note: She will probably not read your appendix describing your calculations, but may ask another economist—me!-- to do so.) The maximum length for the memo is two pages (not counting the graph, the annotated bibliography, or the appendix showing your calculations).

**Provided Sources:** [The assignment lists seven articles provided on the course website. Articles range from peer-reviewed articles on the pricing of parking spaces to newspaper articles.]

### Two pieces of anecdotal evidence that have made Green happy

- A student who had completed the course’s writing assignments informed Green that he had just had an interview for an internship with a local technology company. The student took his writing assignments with him to the interview as Green had suggested. Two weeks later the student sent Green an e-mail:

“I just got a call and have been offered an internship! I wanted to let you know that my portfolio included . . . my Intermediate Microeconomics projects from last quarter and it really impressed them that I had done this kind of analysis.”

- The economics department advisory board has been similarly impressed. Green brought several students to present their policy memos to the advisory board’s quarterly meeting. The advisory board members praised the assignments for building the analysis and communication skills the advisory board members look for when hiring.

## Unpacking Green's Parking Assignment in Light of Vygotsky's "Zone of Proximal Development"

### **Parking Issue as Algorithmic Problem** (*What students can do without help*)

The city of Los Francisco has 22,000 parking spots. In order to raise additional revenue, the city raised the price of parking for from \$1.50 to \$3.00 per hour. At the previous price of \$1.50, the quantity of spots demanded was 23,100 (105% of capacity). Now, at the new price of \$3,00, the quantity demanded is 18,700 (85% of capacity).

- a. Using the midpoint method, calculate the price elasticity of demand for parking spots.
- b. The City of Seattle currently has 8,586 metered parking spaces and would like to reduce demand to 85% of parking capacity. Currently demand is at 100% of capacity and price is \$2.00 per hour. Use the elasticity from above to find the new parking meter fee to achieve demand of 85% of capacity.
- c. What is the change in revenue from parking meters in Seattle due to the increased price?

### **Parking Issue as "Guided Policy Problem" for Homework and Discussion** (*What students can do with help from instructor*)

City and government provided public parking is often priced much lower than private parking lots and garages because the private lots pay close attention to what price consumer are willing to pay. Unfortunately, the low price of publicly provided parking encourages consumers to "hunt" for low priced parking, which leads to increased traffic congestion, accidents and associated pollution. The City of Seattle is considering increasing parking meter fees to reduce the negative impacts of low priced parking. It has been estimated that currently there is an excess demand for public parking resulting in their being more people using and hunting for parking than there are spaces. The estimated quantity and price is 105% of capacity at \$2.00 per hour. Several studies have indicated that the optimal level of demand is 85% of capacity. Further, a recent study showed that the own-price elasticity of demand for parking in San Francisco to be -0.2. Seattle currently has 8,586 metered parking spaces.

- a. What is the current equilibrium quantity, price and revenue from metered parking in Seattle?
- b. Discuss the likely "shape" of the supply curve and what that indicates about the impact of an increase in parking meter fees for the City and consumers.
- c. What is the new parking meter fee that will lead to the optimal quantity of parking?
- d. What is the new amount of revenue for the city and the dead weight loss from the new parking meter fee?
- e. Who bears the burden of the parking meter fee increase?
- f. List and discuss the additional benefits and cost of this policy that are not included in the previous calculations.
- g. Do you think the City of Seattle should proceed with the policy to increase parking meter fees? Why or why not?

### **Parking Issue as Public Policy Recommendation Memo** (*What students can do on their own—Green hopes!—with scaffolding help from previous class discussion of similar problems*)

Students must now do the following on their own:

- Determine which economic theories and models are appropriate for the problem
- Find relevant numbers from research, learning to be comfortable with estimates
- Construct their own algorithmic problems and do the calculations
- Analyze pros and cons of raising parking meter fees
- Write a rhetorical effective memo with supporting graph for Ms. Canon
- Explain and show calculations in technical appendix

## **A GENERAL RATIONALE FOR ASSIGNING EXPLORATORY WRITING**

1. Continually presents students with high-order critical thinking problems
  - Allows instructors to create a questioning, problem-posing environment for the course
  - Immerses students in complexity without being threatening
2. Changes the way students approach reading assignments
  - Encourages students to read for meaning and then to "speak back" to texts
  - Promotes reading for high-level synthesis and understanding
  - Promotes an exploratory stance
3. Creates higher levels of class preparation and richer discussions
  - Students come to class ready to discuss readings
  - Students want to find out what others said in their thinking pieces
  - Generates ideas for discussion; during lull moments a student can be asked what he or she wrote in the thinking piece
  - Plants seeds and gives germination time for ideas; ideas first explored in thinking pieces often get developed in formal papers
4. Enjoyable to read
  - Changes the way you read student writing—you focus on ideas and forget your "red pencil" role
  - Can be read quickly--you can skim them, looking for insights, signs of life
  - Can be sampled--each day you need to read only random samples of the thinking pieces
  - Often lively with voice and personality
5. Let's you learn a lot more about each of your students
  - You'll see the characteristic ways their minds work
  - You'll learn about their backgrounds and values
  - You'll have insights into different kinds of problems they might have
6. Let's you assess learning problems on the spot
  - Will amaze you at the many ways students misunderstand what you say in class
  - Gives you a chance to re-explain something based on student confusion
  - Gives you a constant "reading" of student learning-in-progress

## ASSIGNING AND GRADING EXPLORATORY WRITING

### Explaining Exploratory Writing to Students

- *Explain your time or length requirements for an exploratory piece.* Some teachers say "15 minutes of freewriting" (or 5 or 10 minutes—whatever works best in your situation). Some specify a length limit: "one full page of single-spaced, typed freewriting using a 12-point font." It is easier to score a thinking piece if you specify a length limit rather than a time limit.
- *Explain that an exploratory writing means "thinking aloud on paper."* Tell students that you won't count off for organization, grammar, spelling, and so forth. The purpose of exploratory writing is to get thoughts down on paper—to use the discipline of freewriting to generate thought.
- *Explain that the best ideas in an exploratory piece often come late in a freewriting session.* At the start of an exploratory piece, writers often spill out the most obvious ideas. The writer's own voice and perspective often begin to emerge after a writer runs out of initial ideas. Therefore it is important to keep going—fill that page!
- *Explain that what you are looking for is engaged thought.* Explain that you will reward the process of thought rather than the product. The key question is not "How well written is this piece?" but "To what extent does this piece reveal engaged thinking about the topic?" Explain that you are looking for evidence of dialogic thinking—seeing issues, finding cruxes and puzzles, confronting inadequate explanations, wading into complexity.

### Time saving strategies for scoring exploratory writing

- *Don't read everything your students write.* Just as piano teachers don't listen to their students' practice sessions, you don't need to read all your students' exploratory pieces. Work out a strategy of sampling.
- *Create incentives for doing exploratory writing other than grades.* Weave regular exploratory tasks into the fabric of the course so that students' explorations prime the pump for class discussions and help students generate ideas for formal papers or examinations. Make the tasks interesting and relevant.

### Scales for scoring an exploratory piece

#### Check/plus/minus scale

- *Check:* Indicates the piece meets your expectations for length (or time on task) and for engagement.
- *Plus:* Indicates a strongly engaged, especially high quality exploration.
- *Minus:* Indicates that piece is too short or too superficial

#### Five-point numerical scale

- *Score of 5:* Meets or exceeds required length limit; strongly engaged, especially high quality exploration.
- *Score of 4:* Meets or exceeds required length limit; meets teacher's expectations for engagement
- *Score of 3:* Strongly engaged, high quality exploration, but too short; fails to meet length or time-on-task requirements. OR Meets required length limits but is too superficial.
- *Score of 2 or 1:* Too short and too superficial.