ACS Interdisciplinary Mini-Grants

Final Report

For Mini-Grants Awarded April 2006 and October 2006

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Title of Project: Teaching Critical Thinking To Freshmen Across Disciplines
Date(s) of Project: Fall 2006-May 2007
Amount Awarded: $8000

A. Original Goals and Objectives

Our original proposal explained that one of Millsaps College's primary pedagogical goals is the teaching of critical thinking—the ability to assess claims and evidence, formulate and analyze arguments, and to effectively solve problems. In particular, the College promotes the idea that above all, we do not teach students *what* to think but *how* to think. However, it came to our attention that there is little clarity on exactly how we are to effectively teach critical thinking. The dominant paradigm is to teach critical thinking by modeling such thinking for students in the classroom. We try to teach critical thinking throughout our curriculum by such modeling, and by an emphasis on writing and assessing and producing evidence.

We also stated that the college pays particular attention to critical thinking (or reasoning) in our required freshman seminar course—Liberal Studies 1000 (named changed to Interdisciplinary Studies 1000 or "Core 1" in fall of 2007). Though a laudable strategy in some respects, this current course has two problems: one, its manner of introducing freshmen to critical thinking is inefficient and somewhat haphazard, leaving students with an impression that the course lacks content and faculty with the impression that it does not consistently achieve its goals; two, in an attempt to make this course multidisciplinary, we have included faculty from all departments but have not articulated or created a coherent pedagogical plan that everyone understands and can buy into, leaving us with a case of "too many cooks in the kitchen." Our challenge therefore was to devise a new, more efficient, more systematic, more pedagogically coherent, and more popular way to teach truly interdisciplinary and multidisciplinary critical thinking to all freshmen.

Fortunately, there already appeared to be a better way to teach systematic and effective critical thinking and that was what we sought to accomplish in the pilot teaching program we created. Part of the problem in how we currently teach critical thinking seems to stem from a lack of awareness that Critical Thinking is an established academic field and that the skills of critical thinking can be taught systematically and formally, supported by many excellent textbooks and web-based learning resources (Moore and Parker 2006; Paul and Elder 2003, Ennis 2006; Foundation for Critical Thinking 2006). Calling it a "field"

however, is somewhat misleading. Critical thinking (which may generally be defined as deciding whether to accept, reject, or suspend judgment on a claim by analyzing the presence and relevance of evidence) is the foundation of all disciplines, since all disciplines deal with claims, arguments, reasons, evidence, and conclusions. Our guiding assumption, then, is that critical thinking is meta-disciplinary or ur-disciplinary more than simply inter- or multi-, and as such, systematic training in critical thinking will be valuable for all students, no matter what fields they go into. It is this principle that makes our goals radically interdisciplinary in the true sense of the word "radical," meaning "root"—we aim to teach the roots of thinking. In addition, since faculty from all our disciplines use critical thinking as a foundation, it will be very beneficial for us to be able to jointly organize a course, fully buy in to its structure and rationale, and share a vocabulary, set of goals, and syllabus. Ultimately, our goal is to teach critical thinking skills more extensively and effectively in a truly interdisciplinary foundational freshman course—consistently providing students with valuable skills, and providing faculty with a coherent, organized plan that fits in perfectly with our general curriculum.

Using the experience of a faculty member (Patrick Hopkins) who has taught specific and systematic courses in critical thinking, we decided then to run an experiment in which 6 faculty from 6 different disciplines would teach a consistent, systematic course in critical thinking, using a shared and jointly produced syllabus, specific shared goals, and a shared vocabulary and to compare the educational outcomes of these courses with those of our standard freshman seminar. We made this comparison by using a recognized and widely used form assessment instrument (the Watson Glaser Critical Thinking Appraisal-WGCTA), testing the students in both the systematic critical thinking courses and the standard courses at the beginning and the end of their courses.

The course would be based predominantly on the organization and use of one of the most popular textbooks in the critical thinking field—Critical Thinking, 8th ed., by Brooke Noel Moore and Richard Parker. The course would cover the primary elements of critical thinking. First we would deal specifically with non-argumentative persuasion—attempts to persuade persons to accept or reject a claim without providing relevant evidence or any evidence as to why they should do so (including material relevant to rhetoric, political science, and psychology). Second, we would cover deductive argumentation—the analysis of arguments that attempt to provide conclusive evidence for their conclusions (covering material relevant to logic, mathematics, and philosophy). Third, we would cover inductive argumentation—the analysis of arguments that provide probable evidence for their conclusions (covering statistics, scientific methodology, and causal claims).

In keeping with the intention to remain interdisciplinary and to teach critical thinking skills through practice, the course would also require several sizable interdisciplinary writing assignments that will deal with topics typically separated by disciplines, including an "ethics and policy assignment" (assessing various current arguments for specific contentious moral and political conclusions), a "science assignment" (comparing media reports of scientific studies with the actual published studies themselves to assess accuracy, training students to be critical consumers of scientifically produced information), and an "aesthetics assignment" (comparatively assessing various types of art and literature to

argue for their value and meaning). While these assignments topically reflect specific disciplines on the surface, they work together to show students how they cover a range of mutually illuminating positions, and our guiding principle remains that these apparently different disciplines do not use fundamentally different means of analysis, but rather they all start by using central critical thinking and reasoning skills and only end up later specializing in more or less formal information collection and quantitative methods. In general, we will be training students to understand the structure of arguments, the relevance of evidence, and the nature of claims—in all disciplines.

We designed the critical thinking course and the assessment procedures then to meet the following goals:

- Improve our ability to teach critical thinking by trying a systematic approach, using faculty from different disciplines working together as a team to produce a new, foundational freshman seminar.
- To assess the efficacy of such a course by comparing students critical thinking abilities (as measured by the Watson-Glaser Critical Thinking Appraisal)—those in the formal critical thinking course against those in the standard course both pre- and post-coursework.

B. Outcomes

In the spring of 2006 the faculty who were going to teach the experimental critical thinking freshman course all met once a week to themselves work through the critical thinking textbook under the direction of Patrick Hopkins, who had taught such classes before. While two faculty members had dropped out of the pilot program by that time due to conflicts, the remaining four represented a nice selection from the various departments on campus—philosophy, geology, chemistry, and biology. In addition to working through the course themselves, the faculty also generated a common syllabus and common assignment for the course to be taught.

In the fall of 2006 this group of faculty actually taught the experimental critical thinking course to a group of freshman (four classes of 16 students each). They also continued to meet weekly to discuss methods, styles, problems, and upcoming assignments.

The course and its contents were structured as follows:

The first part of the course (about 1.5 weeks) was dedicated to teaching students to read texts closely, paying attention to details. To that end, we all used an assignment in which students first collectively wrote out the creation story found in Genesis using just their memories. Then we read Genesis 1-3 out loud in class slowly, asking questions about the order of events, the style of writing, and the words that were used. The purpose of this was to get students to see that the text often did not match up with their memories and to get them to realize that texts they think they knew, they may not have known very well. We chose the Genesis text because it is of such huge cultural importance and though most people think they know what it says, most people have not read it. This is a very useful

assignment and gets students thinking about how they get the information they do and how they read a text when they do actually confront it. The purpose of this module was to get student used to determining what specific claims are actually made.

The second part of the course (about 4 weeks) was dedicated to teaching students how to recognize and analyze non-argumentative persuasion and rhetoric. This includes all cases in which people are faced with a claim for which there is no evidence provided at all, or where evidence appears to be provided but actually has not been provided in any relevant way. The study of non-argumentative persuasion includes assessing vagueness and ambiguity, analyzing the credibility of sources of claims, analyzing advertising, and recognizing informal fallacies of reasoning (such as ad hominem attacks, circular reasoning, straw man, hasty conclusion, red herring, etc.). The purpose of this module was to get students used to determining when a claim actually has evidence behind it and when it does not.

The third part of the course (about 3 weeks) was dedicated to teaching students how to assess actual arguments in which claims are made, evidence and reasons are provided to back up that claim, and the evidence is of such a form and nature that it could conclusively prove a claim. This is collectively known as the analysis of deductive arguments and involves the kind of arguments that are typically made in the disciplines of philosophy, logic, and mathematics, but can of course appear in any discipline depending on the structure of the argument. The study of deductive arguments includes assessing the logical structure of the argument (to see if the conclusion actually is proven by the evidence, or premises) by formal means, and to learn how to construct logically valid arguments themselves. The purpose of this module was to get students used to assessing arguments that claimed to prove a conclusion and to get used to constructing logically valid arguments themselves. The second and third part of the course included a major project (see appendix) in which students were to apply their skills at detecting and analyzing faulty reasoning to a current moral or political issue. The project included choosing some appropriate contemporary issue (such as gay marriage, or the war in Iraq, or stem cell research, etc.), gathering two articles that supported some aspect of the issue and two articles that opposed some aspect of the issue, and subjecting each of the four articles to lengthy analysis—specifying all claims made, indicating when evidence was and was not presented for the claims, determining if the evidence was logically relevant to the claims, and assessing the overall strength of the argument when there was argument. The project was very practical, analytical, and specifically focused on applying critical thinking skills to real world issues.

The fourth part of the course (about 4 weeks) was dedicated to teaching students how to assess actual arguments in which claims are made, evidence and reasons are provided to back up that claim, and the evidence is of such a form and nature that it could increase the probability that the conclusion of the argument is true, but cannot definitively prove a conclusion true. This is collectively known as the analysis of inductive and causal arguments and involves the kind of arguments that are typically made in the disciplines of science using statistics and empirical data collection methods. The study of inductive arguments includes learning the essentials of the scientific method, how to generate and

understand scientific questions, learning how to collect data and under what conditions, learning how to shape experiments (particularly in terms of control and experimental groups), and very importantly, how to assess and analyze statistical claims that are made in favor of one hypothesis over another. The purpose of this module of the course was to get students to become scientifically literate, and to become informed consumers of scientific and statistical information. Specifically, they were taught how to interpret statistical claims, and to understand concepts such as averages, standard deviations, generalizations, experimental and control groups, statistical significance, random sampling, error margins, confidence levels, and common problems in scientific practice. This part of the course also included a major project (see appendix) in which students were to apply their skills in assessing and analyzing scientific and statistical claims to a current scientific or survey-based issue present in the news media. The project included choosing some contemporary media report of a scientific study or survey result and analyzing the report for claims made, evidence given, statistics presented, and fallacies or rhetoric present. Then the student was to procure a copy of the original study or survey that the report was based on and compare the media report to the actual study to see if the report had accurately or inaccurately summarized the results of the study or had skewed the interpretation of the study in some particular way. The project was very practical and analytical and focused on applying critical thinking skills to actual real world issues.

The fifth module of the course (about 2 weeks) was dedicated to introducing students to the types of analysis and reasoning that occur in moral, aesthetic, and legal reasoning. This module certainly included all the information that had been learned from the previous modules and so did not have as intense a focus as the others did, but instead entailed applying what they had learned to specific kinds of claim made about morality, aesthetics, and legality. The purpose of this module was simply to acquaint students with basic ideas of value interpretation and to show how critical thinking and the application of principles applies in these fields.

C. Assessment

Our plan for assessing the critical thinking teaching program had three parts.
FIRST:

First, we wanted to see if in fact students learned critical thinking skills over the semester; second, we wanted to know if students liked the course; third, we wanted to know how faculty felt about teaching the course.

For the latter assessment, different faculty had different experiences largely depending on how comfortable they felt teaching in a field they had not taught before (formal critical thinking).

Hopkins (Philosophy) felt good about the course and thought it was exactly what students needed. He felt that students learned how to clearly identity claims, how to determine whether or not evidence had been given for a claim, how to see past rhetorical moves, how to determine basic validity, how to understand and critique scientific claims, and how to

apply these skills to everyday situations. However, Hopkins had taught such a course several times before and his discipline of Philosophy emphasizes the formal knowledge of critical thinking abilities, so he felt most at home in teaching such a class.

McGuire (Biology) felt the course was a valuable learning experience for students (and instructor), far more so than the previous freshman seminar courses she had taught. Her reasons for this include (1) the course did stimulate student thinking and changes/improvements in student critical thinking (they said so, and she observed so); (2) the course was focused (where the previous course seemed to be several disconnected modules); (3) there was objective as well as subjective assessment of students (previously it was only subjective). Overall the students were happy with the course, although for two weeks before course evaluations the class had been working Venn diagrams and truth tables, which they loathed. She suspects this contributed to lower ratings (many students wrote on their evaluations that the least rewarding thing(s) were Venns or truth tables. The other aspect that contributed to lower ratings was her own lack of confidence in the material. The first time a course is taught is always like that, so she suspects had she taught the exact same course this year she would have had much more confidence. She did include a fair amount of content from this course in her re-designed core 1 course for this year.

Stensaas (Chemistry) felt the course was really a lot of work for her because we actually had a formal textbook and content to master. She had never had a philosophy course, so she experienced teaching one as a challenge. In retrospect, she really learned a lot and she thought the students learned a lot, but the course wasn't well-received by students and she doesn't think she would teach it this way again. The course is too different from the way the other freshman seminar sections are taught (we actually gave content exams that counted substantially in their overall grades) and we were viewed as "unfair". By the end of the semester she had to outlaw the words "But the other sections don't have to ..."

Harris (Geology) felt that the course was an improvement over the regular course he has normally taught in that the critical thinking course had specific content and skills production as a focus. However, he felt somewhat out of his element and thought that in light of the students' low evaluations of the course that he did not do a good job in presenting the importance of developing critical thinking skills to the students. He also realized that they appear to have been confused about the goals of the course and were dissatisfied with the textbook, the testing, and the writing assignments.

SECOND:

For the second part of the assessment—how students felt about the class—we relied on our standard course evaluation surveys. Such evaluations are commonly criticized for being too subjective but they are a good measure of whether a student enjoyed the course. Results on evaluations were mixed, again tied rather tightly to the individual instructor and how experienced and comfortable they were with teaching formal critical thinking.

- Hopkins (Philosophy) received a 5.5 rating on "overall rating of the course" [compared to a 5.6 college-wide faculty average], a 6.5 on "overall rating of the

instructor" [compared to a 5.9 college-wide faculty average], a 5.9 on "stimulates student interest" [compared to a 5.7 average] and a 6.3 on "enhanced my proficiency" [compared to a 6.1 average].

- McGuire (Biology) received a 4.8 rating on "overall rating of the course" [compared to a 5.6 college-wide faculty average], a 5.9 on "overall rating of the instructor" [compared to a 5.9 college-wide faculty average], a 5.3 on "stimulates student interest" [compared to a 5.7 average] and a 5.9 on "enhanced my proficiency" [compared to a 6.1 average].
- Stensaas (Chemistry) received a 4.9 rating on "overall rating of the course" [compared to a 5.6 college-wide faculty average], a 6.0 on "overall rating of the instructor" [compared to a 5.9 college-wide faculty average], a 5.3 on "stimulates student interest" [compared to a 5.7 average] and a 6.1 on "enhanced my proficiency" [compared to a 6.1 average].
- Harris (Geology) received a 3.4 rating on "overall rating of the course" [compared to a 5.6 college-wide faculty average], a 5.4 on "overall rating of the instructor" [compared to a 5.9 college-wide faculty average], a 3.4 on "stimulates student interest" [compared to a 5.7 average] and a 5.2 on "enhanced my proficiency" [compared to a 6.1 average].

Overall, we can say about this non-scientific student evaluation that the course was generally not rated highly as a course by the students (but this is actually comparable with ordinary ratings for our freshman seminar which always average considerably lower than the across-the-college course average). Instructors, however were generally rated close to average and above average (consistent with the typically high average our instructors receive college-wide). The most successful class, in terms of student evaluation numbers, was Hopkins, and given the comments of the other instructors, this leads us to conclude that the chief problem with how students received the course was the lack of confidence that non-philosophy instructors had with the critical thinking material. Though we did work through the material for a semester before teaching the course, inevitably it seems that those not familiar with formal critical thinking had less successful teaching experiences than the person who was most familiar and experienced.

THIRD:

Our most important assessment tool, however, was the scientific survey comparison of students' critical thinking skills before and after the critical thinking course. We used an industry-standard measure (the Watson-Glaser Critical Thinking Appraisal-WGCTA), a online questionnaire and problem solving instrument composed of 80 questions which measures ability to make inferences, ability to recognize assumptions, ability to deduce conclusions, ability to interpret results, and the ability to evaluate strength of arguments, all culminating in an overall score which compares critical thinking ability against a norm group—in this case, first-year university students. To emphasize, this is an industry-standard measure, meaning it is commonly used as an assessment tool for employers screening applicants for jobs. It is not commonly used in academic settings, though it does contain norming information for academic cohorts.

We gave the WGCTA to two groups of students—one group was the experimental group who took the formal critical thinking course, the other group was a control group composed of students who took the conventional freshman seminar. We gave each group the WGCTA before they began their class and then again at the end of their semester-long class. The results of the testing were not at all what we expected. Our hope was that students taking the critical thinking course would significantly improve on their WGCTA scores and at a significantly higher rate than those who did not take a critical thinking course. As it turned out, the majority of students did worse on the second WGCTA test than they did on the first. Of the 8 classes taught, the majority of students (ranging from 91% of students to 51% of students) in 7 classes received lower scores the second time tested. In the remaining class, nearly 45% of students scored lower. However, there was no significant difference accounted for by the type of course the students took. That is to say, the variation in scoring was not much accounted for by noting whether the students took the critical thinking course or the regular course. In general, students simply did worse.

Change in Watson Glaser Scores - Pre- and Post-Test

Experimental Group	30 of 44 decreased	68%
	2 of 44 stayed the same	5%
	12 of 44 increased	27%
		100%
Control Group	24 of 42 decreased	57%
	4 of 42 stayed the same	10%
	14 of 42 increased	33%
		100%
All Students	54 of 86 decreased	63%
	6 of 86 stayed the same	7%
	26 of 86 increased	30%
		100%

More specifically: The hypothesis was that the method of teaching critical thinking would have an effect on the critical thinking abilities of students, as measured by a critical thinking standardized test (WGCTA). To create the independent variable for measurement of the critical thinking teaching method, students in the control group were coded 1 and students in the experimental group were coded 2.

Critical thinking scores were measured before and after the class by administering the WGCTA. The dependent variable for the Change in Total Scores on the Watson-Glaser critical thinking test was created by subtracting the Form A (pre-course) Total scores from the Form B (Pre-course) Total scores. When regressing the dependent variable for Change in Total Scores against the independent Control/Experimental variable, the control/experimental variable was found to have no predictive value for the change in critical thinking scores. Specifically, the R-squared (1) of the linear regression model was

.008. This suggests that the independent control/experimental variable explained less than 1% of the variation in the students' change in critical thinking scores. The low R-squared combined with a significance level (2) of 0.421 indicates that the control/experimental variable had no effect on the students' change in critical thinking scores.

> *NOTE: The R-squared is defined as the proportion of variation in the dependent variable that is explained by the regression model. Values of R-squared can range from 0 to 1. Small values in the R-squared indicate that the model does not fit the data well. The significance level (or p-value) is defined as the probability of obtaining results as extreme as the one observed. If the significance level is very small (i.e., less than 0.05), then the correlation is significant and the two variables are linearly related. The correlation is not significant if the significance level is relatively large (e.g., 0.50).*

We also looked at other independent variable and ran regression analyses on them against the total change in scores. We found that:

- The ACT/SAT combined score in high school had no effect on the change in total scores. However, his variable explained 40% of the variation in the pre-test scores (form A) and 32% of the variation in the post-test CT scores (Form B).
- The cumulative fall 2006 GPA no effect on the change in total scores. This variable explained 25% of the variation in the pre-test CT scores (form A) and 24% of the variation in the post-test CT scores (Form B).
- The HS GPA variable showed little effect on the change in total scores.
- Gender had no effect.
- The number of years of the professor had been teaching at Millsaps College had no effect
- There are various subscores of the pre-test and the post-test which can be combined to produce significant R-squared results. This does not affect study conclusions because of collinearity considerations and immateriality.

In short, then, our assessment found that approximately 2/3 of students did worse overall on the second testing than the first, but there is no variable checked that accounts for that worsening. Further analysis of these results is in the next section (D) "Lessons learned".

D. Lessons Learned

FIRST:

Our first lesson learned is that in spite of our college's assertion that critical thinking is taught by all faculty, critical thinking is more specifically tied to the discipline of philosophy than originally thought. The success of the course was that it was much more focused, goal-oriented, and content-ful than most of our freshman seminar classes. The problem was that all the instructors except for the philosophy professor felt like a fish out of water in trying to teach critical thinking formally. While this would no doubt be altered somewhat by experience, it does mean that there is a difficult learning curve and thus is would be quite a challenge to get more non-philosophy instructors to teach formal critical

thinking without considerably more training.

SECOND:

The second lesson learned is that students in general did come out of classes (according to the instructor's subjective assessments) learning to be better critical thinkers and that such a class can be useful. The usefulness though, not surprisingly, is closely tied to the instructor's comfortableness with teaching the material. However, these subjective assessments do not match the objective assessments as measured by the WGCTA tests.

THIRD:

Given the fact that overall, 2/3 of students did worse on the second critical thinking test than the first and given that there was no meaningful difference in changes between those students who took the formal critical thinking course and those who did not, the simplest conclusion to draw would be that teaching freshmen inhibits critical thinking, regardless of whether critical thinking is explicitly taught or not. This would be a very strange result, however, and much more study would be needed to establish that teaching actually inhibits critical thinking.

There are reasons to think instead that this study was inconclusive and that there may have been sources of bias that affected the scores. Recall from the results discussed in section C that no variable accounted for much of the change in scores from pre-test to post-test, including the most important variable of interest—taking or not taking the critical thinking course. This leads us to ask what might have led to an overall worsening of scores and what might have been sources of bias in the study.

In terms of worsening scores, there is the possibility that the worsening was an effect of fatigue rather than pedagogical interference. The pre-test (of necessity) was given at the beginning of the semester when freshmen were alert, energetic, excited, unsettled, and fresh from summer vacation. The post-test (of necessity) was given at the end of the first semester after students were tired, stressed, and concerned about upcoming final exams. This could have had an effect and would potentially explain why the majority of students did worse irrespective of which course they took. It might have been better in retrospect to test them again at the beginning of the next semester after winter holidays had permitted some time to rest. However, logistics would make it difficult to have organized testing in this way.

In terms of bias, there are several possible sources of bias, though how exactly this might have affected the study results is speculative. For one example, the professors who taught the experimental classes (the formal critical thinking) were not randomly assigned but of necessity had to be recruited. As a result, this raises questions about the generalizability of the results. The selection of experimental teachers did involve a substantial amount of recruitment effort and also involved a rate of refusal. This resulted in the experimental class being taught by 3 scientists and one analytic philosopher with a science background while the other classes were taught by a combination of humanities, business, and social

science specialists.

For another example, regression analysis could produce biased estimates if a significant portion of the intended sample refused to participate in the study. It is possible that there was substantial amount of refusal in this study of critical thinking teaching methods. One measure that might suggest that was the dropout rate. In the study, the overall dropout rate was 17%, i.e., the number of students who did not take the Post-test after the semester-long experiment as a percent of the students who took the pre-test. In comparison, 19% of the experimental group dropped out and 14% of the control group dropped out.

Non-response rates

	Total	Experimental Groups	Control Groups
Number of Students Who Completed Pre-Test	103	64	56
Number of Students Who Completed Post-Test	86	54	49
Number of Students Who Did Complete Post-Test	17	10	7
Non-Response Rates (% Who Did Not Complete Post-Test)	17%	19%	14%

In summary then, the possible existence of bias supports a conclusion that the experiment cannot be generalized to the total population of students. It may not be generalized that this method of teaching would not help increase CT scores in other situations.

E. Sharing Results

Since the WGCTA analysis led to such strange results, it is not clear how useful it would be to share such results with others. The non-significant results of the study certainly seem to preclude publication of a paper on the study, which was part of the original intended goal. However, if the sharing of these results is seen to be useful, we would have no objection to doing so, provided that our criticisms of the study and possible sources of bias and the result of inconclusiveness were also fairly addressed. We will be sharing this information, of course, with our own administration, institutional research team, and teachers.

F. Financial Statement

Original Budget

Expense	*Budgeted Amount*	*Actual*
Faculty Stipends	$3000	See Revised Budget
• ***Patrick Hopkins***	• $500	
• ***Sarah Lea McGuire***	• $500	
• ***Kristi Stensaas***	• $500	

• ***Jamie Harris***	• $500
• ***Elise Smith***	• $500
• ***Amy Forbes***	• $500
Team Meetings (food and materials)	$500
Assessment Testing (WGCTA)	$2000
Faculty Conference	$2500
TOTAL	$8000

Revised Budget

Expense	*Budgeted Amount*	*Actual*
Faculty Stipends	$3000	$2000
• ***Patrick Hopkins***	• $500	• $500
• ***Sarah Lea McGuire***	• $500	• $500
• ***Kristi Stensaas***	• $500	• $500
• ***Jamie Harris***	• $500	• $500
• ***Elise Smith***	• $500	• $0 (withdrew)
• ***Amy Forbes***	• $500	• $0 (withdrew)
Team Meetings (food and materials)	$500	$91.69 (less than expected)
Assessment Testing (WGCTA)	$2000	$3000 (more than initially expected)
Faculty Teaching Workshop	$2500	$2908.31
TOTAL	$8000	$8000

Explanation: The original budget had to be amended because of several changes. First, two people dropped out of the program so this reduced faculty stipend spending from $3000 to $2000. Second, we spent far less on food and photocopying materials for team meetings than expected (from $500 to $91.69). Third, the pre- and post-testing materials for the WGCTA cost more than expected, from $2000 to $3000. Fourth, because we have just recently finished the statistical analysis of the formal assessments, we did not have a fall faculty conference on critical thinking. Instead, we held a faculty teaching workshop led by a fellow of the Foundation for Critical Thinking on how to teach critical thinking to students. That used up the remained of the grant money ($2908.31)—though the cost of the workshop was greater than this amount and was supplemented by funds from our own Office of the Dean of Faculty. See Section G for more information on that workshop.

G. Faculty Workshop on Teaching Critical Thinking

Whereas our original goal had been to have the theme of our annual Fall Faculty Conference be on critical thinking, timing was not on our side and the time it took us to analyze the pre and post testing data from the study took us past the point where we could organize the conference. This turned out to be not unwelcome however, since the data analysis was inconclusive. Instead, we used the remaining funds from the grant to hold a faculty teaching workshop June 2-3 2008. The workshop leader was Enoch Hale, a fellow of the Foundation for Critical Thinking, the premier organization promoting the teaching and practical employment of critical thinking (see criticalthinking.org). Hale is a specialist in teaching teachers how to teach their students critical thinking skills. The workshop was a great success. It was attended by 25 faculty members and over two days provided theoretical background in critical thinking, several very useful printed materials, and lots of hands-on practical strategies for teaching critical thinking in our courses. Evaluations of the workshop by faculty attendees were universally positive, with all of them saying they learned a great deal, they found it one of the most useful workshops they had ever attended, and they came away with several practical strategies. The only criticisms were that the workshop was a bit too long on the first day (we went from noon until 5 pm).

H. Permission

I, Patrick D. Hopkins, give ACS permission to post my original proposal and a summary of my work on the ACS Interdisciplinary website.

I. Follow-Up

As a result of the experience of teaching critical thinking, most of the faculty in the courses have elected to continue putting explicit information on critical thinking in their future freshmen seminar class. Also, as a result of the teaching workshop (which reached out to many more faculty than the four who taught in the form critical thinking class), over 20 faculty intend to add more explicit critical thinking elements to their various courses (not just freshman classes). In addition, to keep up the energy and thinking about critical thinking, we will meet again as a group twice in the fall semester to discuss and plan specific critical thinking assignments. This is all very important and useful. It is not the outcome we had originally hoped for, which was to be able to show that teaching formal critical thinking was so successful that everyone should adopt this format—the data simply did not show such an effect. However, while we will not be requiring all freshmen to take formal critical thinking classes, the lessons we learned from this project has led to a large number of faculty more consciously and explicitly including critical thinking into their teaching.

J. Appendices

1. Critical Thinking Essay Project #1

- Choose some contemporary moral/political issue that is being written about now or has been written about in the past year. Examples would include war, gay marriage, legalization of drugs, famous medical cases, political scandals, immigration policy, etc. Whatever you choose, okay this topic with me first!

- Find 3 articles that are generally on "one side" of the issue and 3 articles that are generally on the "other side" of the issue. Articles do not have to address exactly the same aspects of the issue, though they should be roughly recognizable as pro or con. They may all propose somewhat different solutions to the problem. Articles should be at least 300 words long. Don't use little single paragraph USA Today-style things and don't use long in depth reports from professional journals. What you are looking for are popular pieces, such as newspaper editorials, essays from syndicated columnists, official statements from politicians or government offices, transcripts of talk radio shows, etc. The goal is to get short pieces that are trying to persuade the reader or listener to accept or reject some particular claim or position on the issue. Since you will be closely analyzing each article, it needs to be long enough to be substantive, but short enough to be workable.

- This is not a position paper, nor an opinion paper, nor a traditional research paper (strictly speaking). For 95% of this project you will not be expressing your own opinions or arguments on the issue at hand. Your goal will be to analyze the articles you have found using all the tools we have discussed so far in class, particularly looking for rhetorical devices and fallacies. Be as objective and neutral as possible.

MANDATORY STRUCTURE OF THE PROJECT:

- There will be 6 sections to this project, each of which is described below. You must type/computer-print everything in the project except for the photocopies of the articles you use. Use some sort of plastic or treated paper binder to collect those photocopies together. The written project itself should be sent to me by email as a single Word document. Pages must be numbered sequentially from start to finish, not by section.

PROJECT SECTIONS (in the order they should appear in the project)

1. Title page: List your name, the issue you are studying, the name and number of this course, instructor's name, and pledge your work.

2. Introduction: As neutrally as possible, describe the issue you are studying. Describe what are generally perceived to be the key questions (empirical and/or moral) of the issue, what is at stake (in terms of policy or social cost), what are generally perceived to be the major possible positions one could take on the issue, and whether or not dominant "camps" have formed (roughly 1-2 pages).

3. References: List references with full bibliographic information and the page number(s) on which these appear. I don't care what biblio form you use as long as all the information is there. Just pick one from your Hacker book and just the same form for all references.

4. Article analysis: Photocopy each reference article you use and put it in a binder (which you will turn in to me) in the order you analyze them in the project. You will critically analyze each article, making it clear what the title and author of the article is at the beginning of each analysis section. For example, something like this should start each article analysis section:

> Article #1
> Title: Why we should bomb Mars
> Author: Lex Luthor
> Analysis:
> a)…
> b)…
> c)…

Each analysis should run at least 3 pages. An analysis consists of the following sections:

- outline the structure of the article's argument, listing major premises and conclusions; these may be scattered around so you will have to construct a charitable outline of the argument. If there is no argument at all, then construct the most charitable outline of what they seem to be arguing (although most articles will have some type of argument);
- check the article for excessive vagueness, persuasive definitions, slanters, informal fallacies, empirical falsehoods, hypothetical assumptions, and clear cases of fallacious reasoning (all the things we have looked at this semester) and describe all the problems you find (this will form the bulk of your analysis)
- write a short summary paragraph analyzing the strength or soundness of the article (not your opinions). This will be the largest and most important part of the project.

5. Overall critique: Drawing from your 6 analyses, write a 1-2 page critique of the entire debate. This is not your opinion on the issue, but a critique of how the debate actually operates. Ask yourself these questions: Where is the debate headed? What are the chief contested claims the debate seems to revolve around? Are the authors talking about the same issues, or are they talking around each other? Do they repeat claims without offering any evidence for their claims? Are there empirical questions that need to be settled before one can really decide on the issue? Do the authors represent their opponents' arguments fairly? Are the debaters attending to the relevant issues? Are the authors' positions falsifiable? Is this debate a critical thinking bust, or will it really end up yielding a supported conclusion?

6. Your position: Briefly (max 1/2 page) summarize your own position on the issue or explain why you have to suspend judgment. Did the articles you read change or reinforce your position? Do you honestly think you have good arguments for your position?

Please note: you may use a bulleted, numbered, or lettered format for each analysis. The entire thing does not have to be written as a single essay. When writing the analyses however, even if you do use letters or numbers or bullets, write in complete sentences and paragraphs.

Summary of Project Organization

Title
Introduction
References
Article Analyses
- Article #1
  - Title:
  - Author:
  - Analysis:
    - a)…
    - b)…
    - c)…
- Article #2
  - …
- Article #3
  - …
- Article #4
  - …
- Article #5
  - …
- Article #6
  - …

Overall Critique
My Position

2. Critical Thinking Essay Project #2

You are to locate a media report of a scientific study and analyze it, comparing it to the actual scientific study to see how fairly and accurately the media report treated it.

First, locate some media report of a scientific study. This could be any kind of study as long as it was supposedly carried out scientifically. It could be a medical study, a survey or poll, a physics experiment—anything that is described as using scientific methodology. The report could be from a magazine, a newspaper, a television news

show, an online newssite, or even some advocacy organization's announcement or press release. The main goal is to find a case where someone has summarized and reported on someone else's study. Stay away from popular science magazines however, such as Discover or Scientific American. Those articles will be too long. Newspapers and online newssites are probably the best.

Second, you are to locate the original source of the media report. This may be an actual published paper in a scientific journal; it may be the proceedings from a scientific conference; it may be some sort of report from a scientific institution. The important thing is that it is the source of the information in the media report. It can be somewhat difficult to find such materials so give yourself plenty of time. In general, it may be best to find a media report from a year or two ago rather than a brand new report, because sometimes the scientific study isn't published yet and the reporter got their material from listening to a conference presentation. Be prepared to search for the original source. Pay close attention to the media report you find and check to see if is says "a paper appearing in Nature last week" or something like that. That means you can find it easily.

Third, when you have located these materials, you will analyze the media report in essay form. What that means is that you are to introduce your topic and explain what you intend to do (compare the study with the report to see if the report fairly described what the study actually said). You basically need a good introductory paragraph. Then, outline the information in the report, paying attention to any rhetorical devices, and just describe what the report says, what impression it gives, and whether or not it gives much actual data. For example, does it say that a possible treatment for cancer has been found? Global warming has been proven? That people who take Vioxx have heart attacks? That crime has decreased or drug use gone up or beliefs about politics changed? Whatever it says, explain how it comes across. What would a casual reading of the report suggest that scientists had discovered? What emotion laden words, weaslers, or hyperbole seem to be used? Also make certain to note what information is lacking in order to understand the study. Was the type of experiment noted. Or the sample size or the error margins (depending on what kind of study it was). What more would you need to know in order to assess the importance of the study?

Fourth, you will analyze the actual study. What the study actually say? What specific claims does it make? Using the information we are studying about sample size, confidence levels, statistical significance, margins of error, sample representativeness, understanding dependent and independent variables, causation, controlled experiments, etc., explain what the study shows and how expansive or limited the conclusion actually is. The purpose of this analysis is not such much to show problems with the study (though you should do that if you find them), but rather to clearly describe what actual limited conclusion the study provides evidence for.

Fifth, compare the media report to the actual study. Was the report accurate? Was it overblown? Did it suggest something that the study didn't find? Did it not report useful information, like sample size or type of experiment or margin of error (or whatever)? In short, explain whether the report was a good and accurate description of the study or

whether it wasn't. Explain exactly why the report is good or bad, or some mixture.
Write up your analysis (you can use and actually label your sections in the way described above but this is an essay and not a list). Remember, the purpose of this paper is to show that you are a critical interpreter of both scientific studies AND media reports of these studies. Demonstrate your ability to think critically, to analyze, and to understand how to interpret scientific arguments (which are merely formal types of inductive and causal arguments).