

CETL Certificate Program Capstone Project 2005-06
Melanie Frappier
Philosophy Department

“Guided” Essay Exam for Philosophy of Physics Class.

A. Problem: Evaluating advanced critical thinking skills using essays without teaching essay writing in a philosophy of physics class.

The biggest challenge in teaching philosophy 450/550: Philosophy of physics (Einstein’s Science and Philosophy) is to deal with students with very different backgrounds. This is an advanced/graduate class in philosophy of science, but it is open to all. Therefore, although some students are philosophy majors or graduate students with a philosophy major, many students have no or little background in philosophy and at best little experience is essay writing. When trying to complete essay assignments these students often have the following problems:

- a. They have difficulties finding appropriate references to enhance their papers.
- b. They rarely review the main elements of the problem under discussion, thus writing a paper that would be incomprehensible for someone who did not attend class.
- c. They are not able to write a focused paper: they tend to discuss many ideas in a cursory manner, rather than exposing all the details necessary to a thorough understanding of one important problem.
- d. They are not able to structure their paper effectively, discussing the same idea in different section of their essay.

Of course, these abilities could be taught in class and through different writing exercises. Although these would be valuable skills to develop for students with little philosophy training taking this class, focusing on these elements would be detrimental to philosophy majors for whom this course was devised and who already master the basic principles of good philosophical writing.

The problem I faced was therefore to keep the focus of this class on applying, in essays, advanced critical thinking skills to specific material without penalizing students who do not have extensive philosophical training and whose performance on essay exams could be hindered by the lack of writing skills.

B. Solution: “Guided” essay exam

The solution was the preparation of a “guided” essay exam: an essay exam where not only a topic is given, but where students are guided through all the important elements of the answer by a short relevant reading and a series of questions (see appendix). Students who do not feel confident enough to produce a unique essay answering these sub-questions have the option of answering each of them separately.

C. Informal results

The guided exam worked very well.

The exam was a general reflection on a text by Einstein –distributed with the exam – on the evolution of the notion of space. The text fulfilled a double purpose: 1) it delimited the essay topic (the essay turned out to be a critical assessment of Einstein’s paper) and 2) it gave students some background material that summarized what we saw in class and that could be used for further reflection on their part.

Most students with little writing experience decided *not* to write a continuous essay and broke down their assignment into answers to the different assigned questions. In this respect, their essays were more like a short answer exams, which was good: as each question focused on one specific idea, each of their answers were also very focused. Yet, as the questions lead them through the different concepts discussed in class, the sum of their answered led to a general overview of how ideas about space and time have evolved since Newton.

Almost all advanced students produced continuous essays. They were some of the best structured, most focused essays I have ever read from undergraduate students in philosophy of science. What was really exciting is that they did not simply answer each of the suggested questions one after the other: they actually weaved them together to show how the different ideas were related to one another. In this respect, the result they obtained was far more interesting than what we would have obtained in a simple short answer essay for they clearly showed that they understood the relations between the different ideas and saw why classes had unfolded the way they did during the semester.

There were also two unexpected advantages for me as a professor. First, the exams were easier to mark for they all addressed the same elements whether students had or not philosophical training. Secondly, writing the specific questions forced me to find a narrative that linked all my class discussions together. The exam therefore played the role of a class review and it showed me more clearly than a traditional essay exam (where a topic is given, but not broken into parts) which elements I had correctly emphasized and which were missing from my presentations. This led me to develop my final exam (somewhat) in advance, thus helping me prepare more focused lectures that built upon one another. The knowledge I gained while writing these exams will also be very useful the next time I teach the class.

Midterm exam

Due Date: March 7, 2006
(Submit a hard copy in class)

The aim of this exam is to be able to explain how the theory of relativity has changed the ideas we had about space and time.

In his foreword to Max Jammer's *Concepts of Space*, Einstein writes: [For copyright reasons, the text is NOT reproduced here]

Using what we have seen about Newton's *Scholium*, Kant's *Critique*, and Einstein's 1905 paper, write a 5 – 7-page long essay (double space) on the material of the above foreword. Your essay should contain (but not necessarily in this order) the answer to the following questions. You can also, if you prefer, write a short essay answering each of these questions (a length is there only as an indication).

- a) Briefly explain the difference between relative space (concept (a) above) and absolute space (concept (b)) above). (> ½ page)
- b) Einstein says that it required “a sever struggle” to arrive at the idea of an absolute space. Give an argument Newton offers in favor of absolute space. (1 page)
- d) Einstein says that the success of Newton's system silenced the defenders of a relative conception of space for a long time. Yet, philosophically he also received some help from Kant. What is Kant's argument in favor of the absolute Euclidean space used by Newton? (1 page)
- e) The success of Maxwell's electromagnetism was the first empirical indication that the Newtonian conception of space and time was inadequate. Give one way in which Newtonian mechanics and electromagnetism conflict (hint: think of velocity addition and the constancy of the velocity of light). (3/4 page)
- f) Describe how the analysis of simultaneity in special relativity shows us that time (or alternatively, space) is not absolute. (1 ½ page)
- g) Poincaré devised at the same time Einstein did a theory that made the same prediction than special relativity, but where the ether compressed objects moving through it. What was Einstein's reason for completely rejecting the classical conception of space and time (hint: explain the introduction of the 1905 paper on relativity) (1/2 page)