

Proposal for Redesign of Physics 453

Physics 453 is a phenomenological introduction to quantum mechanics taught in a laboratory/lecture format. Students complete seven experiments per semester on topics in modern physics. The lab write-ups form a substantial writing component and act as the students' first serious exposure to technical writing. The course is offered every semester, with an enrollment of about 30 students each semester; the majority of students are physics majors, with astronomy and engineering students as well.

Our proposal is to redesign 453 to include a significant group project. In addition to the intrinsic benefits of working as a group, we have two goals for this change. We feel that an essential part of proficient technical writing is to present results as a team. Furthermore, a group of students will be able to undertake a modern topic and treat it in greater scope than the course currently allows.

Our team consists of professors Ken Gentle and Roger Bengtson, and graduate student Philip Kromer. Dr. Gentle is the department chairman, will teach 453 this fall, and has taught it several times in the past. Dr. Bengtson is the current instructor and taught the course in fall 1996 and fall 1997. Philip Kromer has been Assistant Instructor for the fall 97 and spring 98 (current) semesters, and took the course in the fall 96 semester. We request funding for a summer session salary and tuition for Philip Kromer, and a small allowance for course materials and printing charges.

It is important to expose students to technical writing in a team

Most students in this class, whether they go on to graduate school, go to work in industry, or go into teaching, will be involved in writing, most often as part of a group. Writing as a team carries its own challenges and requires its own skills. We wish to train students in these skills and prepare them to face these challenges. Under the current course plan, lab reports are prepared individually (although the experiments are done in groups of 2-3). We propose that one major experiment be performed in a group of six students. Students will write their findings as a group and publish them on the course web page.

A group project allows increased scope and a more recent topic.

Since each group will have the resources of six students to draw on, the team will be able to explain its results in more depth, and to tackle a more sophisticated topic. We wish to choose an experiment that represents a recent, exciting development in physics – for instance, non-linear dynamics (chaos), or superconductivity. The project may feature computer instrumentation and computer-based data analysis tools, using the computer equipment currently in the 453 lab and in the physics microcomputer lab. The class typically stresses a phenomenological approach -- understanding the basic behavior of the experiment – and we do not wish to shift that focus. Our goal here is to choose a topic that is challenging enough that the group will research and teach the topic to each other, yet one that does not require advanced experimental or mathematical methods. It is a careful balance, and will require some research to achieve.

The proposed features of the project

As with the other 453 labs, the experiment will be set up and tested for the students in advance. The experiment will be performed by each group during class time. The students must prepare for the experiment and research their topic. The group is expected to learn much of the physics on its own. The report will also be prepared as a group; the write-up is to contain contributions from each student. The group as a whole will be graded by the AI on a technical basis, and by the professor on their writing. In addition, part of each student's grade will be assigned by the members of her team. We hope that this will reflect the importance of teamwork – the group will be primarily evaluated as a whole, yet there will be an individual contribution as well. The individual component will act as an incentive yet be small enough to minimize abuse. The grading scheme will be one of the issues we hope to explore.

Evaluating the project

Our goals for the group project include experience in team writing and exposure to a modern topic. In addition, we wish to exploit the intrinsic advantages of a group project: students teach their classmates, fill gaps in their knowledge, gain alternate perspectives, and find incentive to work hard. We have to pinpoint and avoid the pitfalls of a group project: one or two students who dominate the group, or a student who doesn't pull his weight; or a situation in which students parcel off work and work alone to the exclusion of group work. We will make use of the Center for Teaching Effectiveness and the resources of the grant to explore these issues.

Each student will complete a questionnaire that rates the success of the project against the above goals, and assesses the performance of herself and the other group members. The questionnaire will ask each student not only what experience he was able to bring, but also what experience he gained, in lab analysis, experiment, writing, et cetera. We will seek the assistance of the Measurement and Evaluation center in the preparation and administration of the questionnaire.

Budget

Salary for Philip Kromer	\$1302.78 / Month × 3 Months	= \$ 3908.33
Materials		= \$ 90.00
		= \$ 3998.33

Summary

We request one summer session's funding for a graduate student, plus incidental expenses so that we may include an experiment done as a group project. Students will gain experience in technical writing as a team; will pursue a more advanced and current experimental topic; and will profit from the group learning environment. Your support will allow us to investigate the appropriate scope of the project and how to address the challenges of team writing. Furthermore, we will consider how to avoid the pitfalls and how to maximize the advantages of the group process, and develop methods to evaluate our success.

Ken Gentle (Department Chair)

Roger Bengtson

Philip Kromer