Ethics Education Case Studies

School of Physics and Astronomy

Fall Semester, 2011

These materials were first created by the APS Ethics Education Task Force to provide an introduction to some of the issues that practicing physicists might encounter.

This development was undertaken in response to events suggesting that not all participants in science understand what constitutes responsible conduct of science.

In January 2010, the National Science Foundation rdtsblished a requirement that each application for funding in science or engineering research or in education include "**appropriate training and oversight in responsible and ethical conduct of research to undergraduate students, graduate students, and postdoctoral researchers participating in the proposed research project.**"

The NSF requires institutions to provide training plans upon request and to designate one or more persons to oversee compliance of training in the responsible and ethical conduct of research.

The material in these note is more extensively documented on the APS website. Additional resources are clickable on the website:

http://www.aps.org/programs/education/ethics/index.cfm

Ethics Case Study Topics

Conflict of Interest
Data Acquisition
Educational Concerns
Health and Safety
Human Subjects Research
Issues of Bias
Mentoring
Publication Practices
Responsible Conduct of Research

Introduction

Research in physics depends on widely held values of integrity and honesty among participants.

Without these values the enterprise becomes suspect and its results are mistrusted.

It is important as scientists and educators that we demand ethical behavior on the part of all of the participants in all aspects of our enterprise.

It is not sufficient to take for granted that participants are aware of what constitutes ethical behavior.

It is useful to draw the analogy between ethics education and safety training.

Most physicists have an inherent desire to be safe, but the extent to which safety procedures are practiced in the lab depends on a range of factors, including prior experience and an understanding of what appropriate procedures are and what harm may come from failing to follow them.

Formal safety training is often useful to fill in the gaps not filled by prior experience.

Ethics education can play the role of providing information not available from prior experience.

Ethical behavior in some instances can be compromised by pressures to publish and discover, as well as by the prospect of financial gain from commercialization of certain research discoveries.

Researchers may be confronted with choices in which the ethical route is not obvious.

There are also differences between practices in various sub-disciplines, especially in the area of authorship.

Awareness of the ethical dilemmas that can occur in a professional career, and of the resources for understanding and resolving such problems, can help in avoiding ethical lapses or limit the damage that can arise from them.

An understanding of the ethical expectations of the physics community is an important part of a physics education.

Conflicts of Interest

We are often faced with situations in which we could stand to benefit personally.

For example, the use of University resources, telephone numbers, e-mail or web addresses to support or represent an outside activity, including businesses, hobbies and political activities, constitute conflicts of interest.

Usually the technical regulations concerning conflict of interest are well documented.

Regulations prohibit employees from improper participation in a variety of business transactions in which the employee may have an interest or be in a position to assist others, particularly those whom the employee may have a direct or substantial economic interest (such as a spouse, or child).

Appointments, terminations, promotions, demotions, and approval of salary increases all need therefore to be carefully considered from the perspective of conflict of interest.

For some ethical issues there are no clear guidelines to follow.

Questions

1. Define conflict of interest and provide three examples.
2. Determine if the institution you are attending has documentation on conflicts of interest and, if so, describe what this documentation states.

Conflict of Interest Case Study: Confidentiality
Scenario 1

You are a 6th year graduate student or a postdoc at a large university in the final months of your dissertation research on novel photonic materials. You are worried about your next appointment, and have applied for several postdoctoral positions in this field plus a few tenure-track assistant professorships at universities where you would like to work. To your surprise and pleasure, you are invited for an interview for a tenure-track appointment at your undergraduate alma mater, a prestigious research institution in a city where you already have connections and would love to live.

In the question and answer period following your seminar on your research, the department chair asks for detailed information about the novel material-preparation technique developed in your graduate research, and used extensively in your experiments. Your group is working on a patent application and its members have agreed not to provide details until a paper currently being prepared is submitted for publication. Your thesis advisor will be giving the first major presentation on the technique at a major international conference in a couple months.

You answer that you and your colleagues are in the process of writing it up for publication and a patent application, and you would be glad to send them an early preprint when it is available. The question and answer period continues and concludes uneventfully and pleasantly.

After the seminar, in your private interview with the Chair, he pushes harder for this information, remarking that the Department seeks team players, willing to share information with department colleagues, and referring to your undergraduate roots and the need to prove you are one of them to be a viable candidate for the position.

What should you do?

Data Acquisition

Testing of scientific theories through experimentation is at the heart of the scientific endeavor. How data is acquired, recorded, and stored is thus of fundamental importance to progress in science.

The APS Guidelines for Professional Conduct state:

> The results of research should be recorded and maintained in a form that allows analysis and review. Research data should be immediately available to scientific collaborators. Following publication, the data should be retained for a reasonable period in order to be available promptly and completely to responsible scientists. Exceptions may be appropriate in certain circumstances in order to preserve privacy, to assure patent protection, or for similar reasons.

1. *Indicate a set of procedures you might use when acquiring data for your research?*
2. *How would these procedures help assure the integrity of the research record.*

Data Acquisition Case Study: Intellectual Property

You find a novel solution to an important problem posed by your advisor, however, your advisor sees this as an opportunity for him to get published, downplays the significance of the results, collates a paper and submits it before you are any the wiser (acknowledging a discussion with you, but not including you as an author). You are absolutely clear that this idea was yours, and feel suitably put out. You approach your advisor and make a complaint, but he empathizes with you and tells you to be a bit quicker with the write up next time. He tells you, "That's just the way of the world." You decide not to leave it there, and approach the head of the department (going up one link in the management chain). You make your complaint to him, and he asks you for evidence, but you can't provide any because you didn't keep a dated notebook: all of your notes are in several ring binders, some at home and some in your desk at work. You start feeling a bit silly, and the head advises you to drop the matter.

Questions

Should you drop this? Should you chalk this one up to experience, or is there a fair way to make a claim to the results?

Educational Concerns

Ethics in science is primarily learned informally through mentors and by observing the behavior of those around us.

Our experience as undergraduates and graduate students is the first time we encounter any ethical questions specifically related to science.

Issues involving data collection, authorship, and collaboration might easily be encountered for the first time when a student participates in a summer research program.

Conflicts that involve students can be magnified when there are imbalances in experience, status, or power.

Educational Concerns Case Study: Reporting Violations and Plagiarism

You are a student working collaboratively with other students and a professor writing a paper.
You discover either by employing Google or some other software, that large parts of a section written by someone else have been lifted, verbatim, from the web or a published paper with no quotation marks or citations.

Question

What should you do? Consider reviewing the Plagiarism Web Site from the University of Virginia, Charlottesville

Health & Safety

Issues of health and safety are important in the context of any sort of experimental research.

In the past, researchers and their supervisors have demonstrated a cavalier attitude towards these issues, which is inconsistent with current legal and ethical standards.

It is essential that all researchers have training that prepares them for the hazards, and possible emergencies that they may encounter in the course of their work, and that all laws and regulations relating to safety are adhered to, and best practices be employed when there are hazards.

This means that there should be compliance with all accepted safety standards.

Researchers also have an obligation to carry out their work in a manner that does not threaten the health and safety of others, and to be forthcoming in identifying new risks and to be rapid in their response to hazardous conditions and emergencies that may arise.

Health and safety standards are usually rigorously followed in large laboratory settings.

It is important to recognize that they be followed even in the most modest of research settings.

1. *What are the safety standards you need to follow with your work?*

2. *What are some common safety standards that are followed in undergraduate lab work?*

Health & Safety Case Study: Hazardous Materials

A condensed matter experimentalist and his students were conducting experiments on thin films of common metals such as aluminum and tin. They realized that they could substantially enhance their work by switching the samples to the metal beryllium, which is highly toxic and can bring about irreversible poisoning. The procedures that they are employing with aluminum and tin would not be suitable for a toxic material such as beryllium.

Questions

What responsibility does the PI have in considering the new, potentially dangerous material for the research? What role should the students have in making this decision? If there is a decision to go ahead with the work, what is the PI's responsibility in terms of providing information and training? How should he or she proceed with setting up these new experiments in a manner that might ensure the safety of his students?

Research with Human Subjects

While it is not frequent, occasionally physicists perform research involving human subjects. Examples of such research include: educational studies, biophysics investigations, and surveys.

Federally funded institutions are required to have appropriate procedures in place to ensure that the health and privacy of human subjects are protected. Institutions generally have one or more committees set up to review proposals for research involving human subjects.

Certain types of minimal risk research may be exempt from oversight, including some forms of education-related research. However, the investigator is not allowed to make the determination of exempt status on his or her own; the institution's human subjects review board makes that decision.

The regulations governing human subjects research are lengthy and complex. Fortunately, another requirement of federally funded institutions is that they make human subjects research training available.

Research with Human Subjects Case Study:

Education Research

Suppose you have a strong interest in physics education, and in pursuit of that interest you want to assess the effectiveness of two different strategies for running recitation sections in large introductory physics courses. The professor who runs the course agrees that both of your proposed strategies have educational merit and that you can try them out on two independent sections of the class. At the end of the term, you discover a clear difference in test performance between the students in the two different groups. You want to give a talk at an American Association of Physics Teachers meeting about your results.

Question

What steps do you need to take in order to ensure the privacy of the students is adequately protected?

Issues of Bias

Webster's New World Dictionary (*Webster's New World Dictionary of the American Language,* David B. Guralnik, Editor in Chief, Second College Edition, William Collins + World Publishing Co. Inc. (1978).) defines bias as "a mental leaning or inclination; partiality; prejudice; bent."

Scientists are expected to be objective, open to learning the truth from their research. Yet, even physicists are human. Each of us has our own likes and dislikes, preferences and pre-conceptions, and "hot buttons" that make us feel angry, uneasy, or uncomfortable.

Bias can damage research, if the researcher chooses to allow his bias to distort the measurements and observations or their interpretation.

When faculty are biased about individual students in their courses, they may grade some students more or less favorably than others, which is not fair to any of the students.

In a research group, favored students and colleagues may get the best assignments and helpful mentoring.

People often prefer associating with other people who are similar to themselves, their family members, or their friends.

The net result of these biases hurts physics, because people who are different and would bring valuable new perspectives to the field have traditionally been excluded or discouraged by those already in the field.

It is not unusual for women, African Americans, Hispanics, and Native Americans to feel unwelcome in physics and other scientific fields, because of the low expectations their professors and colleagues have for them, and because of how they are treated by the people who should be their peers and colleagues.

While it is probably impossible to eliminate bias, each person can strive to be aware of his or her preferences and alert to situations where the bias can be damaging to the science or ones colleagues.

Also, one can become a careful observer of others and take action to counteract the unfair or inappropriate consequences of biases, especially those that work to exclude or diminish people from different backgrounds than the majority.

Issues of Bias Case Study: Bias in Hiring

You are a female physicist applying for a position you want very much at a prestigious albeit relatively conservative university. During the interview process you are asked about whether you have a husband or significant other in the same field.

Question
Should you answer this question?

Issues of Bias Case Study: Reaction to Bias

The graduate students, post-docs, and professor in your research group have spent the past week brainstorming ideas for a major new proposal to submit to the National Science Foundation. After much discussion, the professor selects Sally's idea to be the core of the proposal, and invites John to be Co-PI with him, and to take the lead in coordinating preparation of the proposal. Both Sally and John are senior post-docs in the lab. It is a real honor and a career advantage to be a PI early in one's career. By offering one of his post-docs the opportunity to be Co-PI and work with him on preparing the grant, the professor is helping launch the post-doc's career. The issue is, why didn't the professor offer this opportunity to Sally, since the core idea in the proposal was hers?

Questions
In considering this scenario, how should the different students and post-docs respond to this decision by the professor? What should Sally do? What are John’s responsibilities? Is it too unrealistic to suggest to John that he express his concern to the professor?

Mentoring

Mentoring is the act of providing resources to encourage healthy growth.

Mentoring can involve individual relationships ranging from a casual offer of advice up to an apprentice relationship.

Mentoring implicitly involves expectations; both the mentor and the mentee should have realistic and well understood goals for the timing and product of the relationship.

The ethics of one-on-one mentoring involves how the mentoring expectations are formulated and met.

Group leaders, from department chairs to research directors, have an ethical obligation to create an environment that supports fair treatment and professional development opportunities for all group members.

Mentoring issues can overlap with issues of bias, health and safety and maintaining the intrinsic ethical standards of the discipline.

Mentoring Case Study: Mentoring Scenario 5

You are a student from a very small undergraduate institution, accepted for graduate study in a prestigious university. Your first year is covered by a scholarship. When you arrive, your advisors place you in the standard first year graduate classes. You have doubts about your background.

Question

What should you do? What are some possible questions an outside observer might ask?

Publication Practices

The *APS Guidelines for Professional Conduct* (see appendix) state that authorship should be limited to those who have made a significant contribution to the concept, design, execution or interpretation of the research study.

Other individuals who have contributed to the study should be acknowledged, but not identified as authors.

The sources of financial support for the project should be disclosed.

Plagiarism constitutes unethical scientific behavior and is never acceptable. Proper acknowledgement of the work of others used in a research project must always be given.

Further, it is the obligation of each author to provide prompt retractions or corrections of errors in published works.

Publication Practices Case Study: Authorship
You are involved in collaboration, and research results are about to be published.

Question
What factors will determine if you will be listed as an author, and if so, where your name will appear on that list?

Publication Practices Case Study: Conflict of Interest in Refereeing

A referee claimed to have been coincidentally working on the same problem that appeared in a paper he was sent to review. He made a positive review, and then went on to publish his own paper on the subject. The original author took note, and complained to the journal. When approached, the referee pleaded with the journal that his institution not be contacted, apologized profusely, sometimes tacitly admitting and sometimes denying any guilt.

Questions
What action should the journal in question have taken? Should the editors notify the referee's institution? What should the author have done to avoid this mess?

Publishing Practices Case Study: Credit for Work

As a graduate student, you have worked closely with a professor and her post-doc on a project studying experimental techniques in microfluidics. The project is going very well and you've even published some of your initial results. You will be graduating this spring with your master's degree. Your advisor is now writing a subsequent paper with a colleague who is developing a theory that accounts for your results. You see a draft of the paper and notice that you are not listed as one of the four authors of the paper, who are the professors and their senior post-docs. However, the paper is directly based on the work that you did and includes a new experimental plot that you created in addition to the theoretical calculations.

Question

What should you do?

Publication Practices Case Study: Errata in Previous Research

A research group publishes a couple of papers on an important discovery in two different high impact journals. A new graduate student is given the task of reproducing and extending the work of the advisor and a post-doc. After several weeks of experimentation he realizes that he cannot reproduce the work reported earlier. He even has an explanation for the error.

Question

What are the optimum courses of action for the student, the advisor and the post-doc, who in the interim, has left to take up a new job.

Publication Practices Case Study: Fabrication, Falsification and Plagiarism

You are a co-author on a recent paper that was rejected. The referee made a couple good points that called into question a section of the paper. The lead author, a fellow graduate student, is responsible for rewriting this section of the paper. When you read the new version, you see that he has changed some of the numbers to address the referee comments. His response to the referee is that upon double-checking the data, there was indeed a mistake and the referee was correct in noticing something was amiss. This student hopes to graduate within the next year and you are aware that he is desperate to publish something before starting a job search. You are skeptical of your lab-mate's explanation for the error, but don't have any specific knowledge of wrongdoing.

Question

What should you do?

Alternative Problem

A PI, who is desperate to publish in order to secure a grant renewal, has just been told by his junior student of concerns about the above paper. How might or should a PI in this situation respond to this concern?

Publication Practices Case Study: Publication and Data Ownership

A graduate student became impatient with the care his advisor was taking in making certain of the correctness of their joint experimental work. He decided that he could wait no longer to publish a paper. On his own, and unbeknownst to his advisor, he wrote up a manuscript and submitted it to *Physical Review Letters* with his advisor and some other students as co-authors. The editor at the time became suspicious of the manuscript, because of the writing style, and the fact that the advisor as senior author did not submit it. He phoned up the advisor and asked him if he had been a party to the submission. It turned out that the advisor did not know about it at all.

Question

What should the advisor do about the manuscript and about the student's ethical lapse?

Responsible Conduct of Research and Participation

Scientists and educators have a duty to obey rules and regulations regarding the responsible conduct of research and ethical participation in the activities of their department, laboratory, or company.

For publicly supported research this means adhering to both institutional and federal rules (e.g. OMB Circular A21 for federally supported research at universities) in making expenditures and acting in a manner that recognizes the importance of spending taxpayers money wisely, and with as little waste as possible.

Research support is not an entitlement.

In the course of working within a company, a national laboratory or a university department there are also issues of ethics and fairness, which should govern day-to-day behavior.

Responsible Conduct of Research and Participation
Case Study: Interface with the Public: Signing a Petition

In the 1980's, President Ronald Reagan proposed building a missile defense system that would provide a defensive shield for the United States. The Strategic Defense Initiative was heavily funded, opening up research opportunities for physicists, engineers, and computer scientists among others. In 1985, a petition circulated among many physics departments in the U.S. It read in part:

We, the undersigned science and engineering faculty, believe that the Strategic Defense Initiative (SDI) program (commonly known as Star Wars) is ill conceived and dangerous….
Participation in SDI by individual researchers would lend their institution's name to a program of dubious scientific validity, and give legitimacy to this program at a time when the involvement of prestigious research institutions is being sought to increase Congressional support….
Accordingly, as working scientists and engineers, we pledge neither to solicit nor accept SDI funds, and encourage others to join us in this refusal. We hope together to persuade the public and Congress not to support this deeply misguided and dangerous program.

Question

Setting aside for a moment the specifics of SDI, under what circumstances is it appropriate to sign a petition such as this?

What does signing a petition say to society?