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Introduction to Ethics in the Science Classroom

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Description

This is the introduction to Michael Pritchard and Theodore Golding's instructor guide, "Ethics in the Science Classroom."

Body

Introduction[1]

The instructional material and lessons included in this volume had their origins in a National Science Foundation (NSF)-funded program in which one of the present authors was the director (TG) and the other the project consultant (MP).[2] That program, for Long Island, New York secondary school science teachers, included two-week summer institutes in 1994, '95 and '96 and school year follow-up sessions. The program was designed to encourage teachers to include ethics and values content in their classroom science lessons.

We became convinced of the need for that endeavor as a result of frustration experienced during efforts to teach research ethics to undergraduate science majors and beginning graduate students. Such instruction is currently mandated or encouraged by major science funding agencies including the National Institutes of Health and the NSF.3 Although most senior undergraduate and graduate students can be persuaded of the need to learn about the ethical issues associated with scientific research, it is our experience that few, if any, of them have had any preparation for such learning in their prior science classroom experience. With the exception of biology, where some aspects of medical and bio-ethics have made inroads, considerations of ethics and values play almost no role in pre-college or college science instruction.4 As a result, students tend to have a very narrow conception of the ways in which ethics and values enter into the practice or societal use of science. After years of instruction that either explicitly or implicitly reinforced the concepts of the total objectivity and value neutrality of science, students are resistant to parting with these idealizations. Our growing conviction that the ethics/science connection should be introduced and explored much earlier in a student's education was validated by the spontaneous suggestion to that effect in evaluations of our college- and graduate-level instructional efforts by our students.

One concern that is often raised by teachers is that national, state and local science curricula do not prescribe the inclusion of ethics and values in science instruction. While it is true that mandated or recommended subject matter content rarely makes explicit mention of ethics, many recent science education goals, objectives and standards documents include topics that intrinsically incorporate ethics and values issues. The *National Science Standards* recently published by the National Research Council5 contains numerous recommendations in its Science Content Standards for subject matter that includes ethics and values components throughout the K-12 curriculum under such headings "Science as Inquiry," "Science in Personal and Social Perspectives," and "History and Nature of Science." The content standard for grades 9-12 in the "History and Nature of Science" category focuses on science as a human endeavor and the nature of scientific knowledge. Explicit reference is made to the ethical norms of scientific inquiry and to the values that influence scientists' judgments. Many state curriculum content guides include similar topics with ethics content. For example the student understandings of the nature of science prescribed in *Florida's Sunshine State Standards: Science, 1996*6 include the influence of funding agencies on the areas of scientific inquiry; the constraints imposed by political, social, and ethic values on technological design; the need to seek out

sources of bias and report data truthfully; and concerns about the ethical treatment of human and animal research subjects. Michigan's *Essential Goals and Objectives for Science Education (K-12)*7[7] include understandings of the limitations of scientific knowledge; the influence of political, social and cultural factors on the development of science; and the risks and benefits of new technologies.

Almost all of the 76 high school, junior high and middle school science teachers who enrolled in one of our Summer institute programs began with the conviction that there was a need for their students to learn about ethics in science. Most often this was inspired by such common unethical behavior in their classrooms and laboratories as fudging experimental data and the reporting of anticipated rather than actual observations. Despite having received a set of pre-institute readings that introduced them to a wide variety of connections between science and ethics/values, most of the teachers entered the course with a narrow focus on such obvious issues as fraud, data manipulation and plagiarism. They were, however, generally receptive to broadening this perspective to include a much wider range of issues. Discussions of such topics as the influence of funding sources and competitive pressures on scientists, social responsibilities of scientists, and ethical issues related to biotechnology, the Human Genome Project, environmental protection, research on human subjects and animal rights took place with obvious interest and enthusiasm.

We were pleasantly surprised by the creativity displayed by the teachers in the key, lesson-planning phase of the program. Teachers worked both individually and in groups to produce classroom exercises incorporating some of the ethics/values issues that we had discussed. The expectation was that the teachers would make use of these lessons in their own courses during the following school year. This proved to be the case, as reported at the follow-up sessions held during December and April of the school year. Many teachers also introduced additional ethics/values lessons, which they had devised after the Summer institute, and some made use of lessons that had been created by other institute participants.

The level of enthusiasm in the descriptions of the success teachers experienced in the use of the lessons is encouragingly high. The overwhelming consensus is that students in all secondary school science courses find the science ethics lessons to be interesting and stimulating. An apparent, unanticipated benefit to infusing science curricula with ethics/values issues is that topics that students previously considered dull, tedious or dry are viewed more favorably when such topics are introduced along with related ethical considerations. The teachers attribute this increased

student interest to the fact that material that was formerly viewed as unrelated to real life concerns has been "humanized." For example, one physics teacher found that he could greatly increase his students interest and involvement in learning about momentum by coupling it to a discussion of the ethical issues involved in requiring automobile passengers to wear seat belts. These types of teaching activities will focus students' attention on their own behavior. Although lessons that stress and illuminate the importance of honesty in recording and reporting scientific data certainly do not eliminate student dishonesty our teachers reported that they do result in more self-conscious, thoughtful behavior.

In the course of preparing this volume, we contacted the teachers one to three years after they had participated in the project. We were pleased to discover that most of them continue to use ethics and values lessons in their science teaching. Three of the teachers credit the institute experience with inspiring them to create year-long elective science courses containing a series of lessons designed to illustrate and teach many of the ethics/values in science issues we explored. Most of the teachers include at least one brief lesson early in the school year that is designed to introduce students to the relationships between science and ethics/values issues. This is followed later in the school year by additional lessons in which particular ethics issues related to the course subject matter are explored in some detail. A significant minority of the teachers follow a much more ambitious program in which ethical considerations are incorporated in lessons throughout the year, sometimes on an almost daily basis. These teachers found that by taking advantage of the resulting enhanced student interest, they were able to design lessons that include ethics/values content without displacing other prescribed course content.

We are convinced that student understanding of science and the increasingly important role science plays in our society is enhanced by the infusion of ethics/values content. The success of our program inspired us to create the materials you now have in your hands. We hope to encourage other science teachers to enhance their classroom offerings in the same way that the Long Island teachers who participated in our institutes have found to be so fruitful.

Our plan is as follows: Section I of this book contains educational material derived from the introductory phase of our summer institute offerings, which developed and evolved over the three-year life-span of that program. The initial chapter is an analysis of science, which like all human activities, is infused with the values of its practitioners. We examine the many ways that science and ethics/values intersect,

with regard to both the doing of science and in the societal uses of the results of scientific research. The second chapter is designed to provide an answer to the question "What is ethics?" We present an introduction to the current state of knowledge about moral development and to the different types of reasoning that are used in making ethical judgments. We show that students of all ages are capable of critical reflection and ethical reasoning. As an example of the practical application of the employment of ethical principles and concepts in a science context we explore the development of the guidelines that are used by institutional review boards that are charged with reviewing proposals for research involving human subjects or laboratory animals. Chapter 3 is devoted to the teaching of ethics. We begin with a set of objectives and the assumptions about students that they presume. Concern about whether ethics can or should be taught in the classroom is countered by the response that ethics can certainly be profitably studied with the vital goal of stimulating a student's moral imagination. Examples are given of how to help students recognize moral issues and to analyze key moral concepts and issues. In Chapter 4 we present a series of six cases studies, including five that our Long Island teachers found to be very illuminating. Each one of the cases is based on actual events and they are designed to probe ethics/values issues related to scientific fraud; the collection, manipulation and presentation of data; experiments on human subjects; genetics research and technology; competition among scientists; assignment of credit for scientific discoveries; and the effects of sexism and racism on science.

The second section of the book presents guidelines for, and examples of, classroom lessons incorporating ethics/values in secondary school science teaching. To aid this process, we begin with a presentation of suggestions and guidelines for the creation of such lessons. Next, we present 23 model lessons, which are edited or revised versions of lessons created by teachers in our institutes. These lessons cover a wide range of topics and levels of sophistication. We have assigned a category to each lesson that we think best describes its principal emphases - introduction to ethics/values, behavior of scientists, behavior of science students, social issues, research on humans and animals, or pedagogy. We also indicate the student academic level(s) and science course(s) for which we think each lesson is suitable. Our aim is to provide examples of ethics/values instructional materials that can be used by any teacher of a science class from middle school (sixth grade) through senior high school. We hope that science teachers will be encouraged to develop additional lessons that are tailored to their own unique teaching needs. A

bibliography and listing of Internet and other non- print resources constitutes the final part of Section II.

- 1The writing of this text was supported by National Science Foundation Grant No. SBR-9601284: "Infusion of Ethics and Values in Pre-College Science Training."
- 2National Science Foundation Grant No. SBR-9320255: "Workshops For High School Science Teachers: Ethics in the Classroom."
- 3For example, since July 1990 the National Institutes of Health have required that all recipients of their research training grants receive a program of instruction in the responsible conduct of research.
- 4A notable exception is the work of physics professor Marshall Thomsen, who has developed and taught an undergraduate course on ethics in physics, and organized workshops on ethical issues in physics in 1993 and 1996, the proceedings of which may be obtained by writing to him at: Dept. of Physics and Astronomy, Eastern Michigan University, Ypsilanti, MI 48197.
- 5National Research Council, Science Education Standards (Washington, D.C.: National Academy Press, 1996).
- 6Florida Department of Education, Florida Curriculum Framework: Science (Tallahassee, FL: Florida Department of Education, 1996).
- 7Michigan State Board of Education, New Directions for Science Education in Michigan (Lansing Michigan: Michigan Department of education, 1991).

Resource Type

Instructor Materials

Parent Collection

Ethics in the Science Classroom

Topics

Case Study Method
Pedagogical Approaches

Discipline(s)

Teaching Ethics in STEM