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FOR ENGINEERING AND SCIENCE

Incorporating Ethics in Classroom Science Lessons

Ethics in the Science Classroom Section II

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Year

2000

Description

Section II of Michael Pritchard and Theodore Goldfarb's instructor guide, "Ethics in the Science Classroom."

Body

PART 1: Creating Your Own Ethics-in-Science Lessons

Teaching Ethics and Values in *Your* Science Classroom

In Section II, Part 2 we will present twenty-three edited versions of model lessons originally developed by teachers who participated in our program. In principle, a teacher of any secondary school science course should be able to select from this set at least two or three lessons that can be used in her own classroom which serve to meet some, or all, of the basic objectives of any program of ethics and values instruction discussed in Section I, Chapter 4. In practice, however, each teacher's

classroom needs are unique. This point was stressed by our institute teachers. Thus, although most of them did make use of lessons developed by other participants, almost all of them found it necessary to construct lessons specifically tailored to their own interests and the needs and abilities of their own students.

During the second and third summers of our program our institute staff included teachers who had been participants during one of the previous years. These participant-instructors, Ms. Phyllis Satz, Mr. David Flatley and Mr.Vincent Sydlansky were specifically charged with the task of aiding the teachers in the development of their ethics and values classroom lessons. Many of the suggestions and comments that we offer here are based upon the creative work of these three talented teachers.

Some Basic Observations and Suggestions

Teachers are accustomed to carefully considering the goals and objectives of their classroom science lessons. This should apply equally to lessons designed to explore ethics and values in science. Many of the teachers who enrolled in our institutes began with a rather narrow conception of the purpose of ethics education. They mistakenly identified the study of ethics exclusively with the examination of dilemmas. A dilemma poses a choice among mutually exclusive options, none of which appears to be completely satisfactory. Whatever choice is made will result in some negative consequence, so the right or preferable choice is not clear. Ethics education was seen only as encouraging students to examine the ethics and underlying values associated with choosing among the possible courses of action in such "dilemma" cases.

In Part I, Chapter 3 we presented the following five goals of ethics education: Stimulating the moral imagination of students; Helping students recognize moral issues; Helping students analyze moral concepts and principles; Stimulating students' sense of responsibility; Helping students deal effectively with moral ambiguity and disagreement. Dilemma cases are specifically associated only with the last of these basic objectives. Although it is true that exploring dilemmas *can* involve the other four objectives it is important to make students aware that morality and values do not arise primarily in the face of a dilemma. Furthermore, cases involving moral ambiguity need not be dilemmas -- they can simply involve situations where making a good choice requires more thoughtful analysis. The universal goal of infusing ethics and values into science education is to reveal that

as in all human endeavors, most of the actions of those that practice or use science involve choices with moral implications.

A second common mistaken notion is that the only way to avoid indoctrination when teaching ethics and values is to encourage the notion that all ethical choices are equally valid. The fact that few if any of us would want our students to become the kind of amoral agent who accepts the validity of that notion should be sufficient to discredit it. Indoctrination should indeed be avoided. Students should be encouraged to explore and express a wide range of ethics and values positions including those that may be viewed by other students (or the teacher) as socially or personally unacceptable. But students (and teachers) should also be expected to defend their positions and choices and to accept responsibility for their actions.

A problem commonly raised with regard to ethics education is that it may raise strong objections among the citizens, parents and school board members to whom teachers are ultimately beholden. Curiously, although this concern was voiced by many of our Long Island institute participants, few of them felt personally constrained by potential censorship. Most of them felt relatively free to introduce such sensitive issues as abortion and sexual preference in their classrooms. While this may be less true in other parts of the country, we suggest that teachers cautiously test the waters before assuming that an important issue related to ethics in science is indeed taboo.

Ethics and values education, like most other academic endeavors requires the use of terms with specific meaning. Although we do not propose that the science classroom is the proper venue for detailed introduction to the study of ethics it is necessary to begin with a lesson that presents some basic definitions and concepts Some initial attention should also be paid to persuading students of the validity of some of the connections between ethics and science discussed in Part I, Chapter 1.

Sources for Ethics in Science Lessons

A wide variety of sources are available to draw upon for the development of science classroom ethics lessons. These include:

- Books on ethics in science and scientific integrity.
- Articles on scientific ethics and case studies in journals like *The Science Teacher, The Biology Teacher, Journal of College Science Teaching,* and *The Hastings Center Report*.

- Science articles in newspapers and news magazines.
- Ethics lessons in existing science texts like the Biological Sciences Curriculum Study (BSCS) materials.
- Numerous education and science related ethics websites.
- The Woodrow Wilson Biology Institute website.
- Science fiction stories - books and videos.
- Ethics in science videos
- The case studies in Section I, Chapter 4

The resource listings in Part 3 of this Section contain references to specific examples of many of these materials. One particular resource that deserves attention because it is received by a large percentage of science teachers is the *National Science Teachers Publications Catalog* which includes a wide variety of educational materials distributed by the NSTA. Of the numerous publications and other resources listed in the most recent catalog, the one that science teachers are likely to find most useful in designing values and ethics lessons is *Real Science, Real Decisions.* It is a collection of "Thinking Activities" reprinted from *The Science Teacher* about ten different controversial issues associated with contemporary science. Many of the ethics/values questions are highlighted in a background piece on the subject designed for teachers and a briefer discussion of the topic with questions written for students.

Several of the other publications distributed by the NSTA are fruitful sources of materials for constructing ethics-in-science lessons -- but the lesson maker will have to draw attention to, and spell out the ethics issues, since the texts themselves make no mention of the related ethics/values questions. Such publications include a series of "event-based science modules," entitled *Oil Spill!*; *Earthquake!*; *Hurricane!*; *Toxic Leak!*; *Flood!*; *Asteroid!*; *Gold Rush!*; *Tornado!*; and *Volcano!* Each includes a student booklet and accompanying teacher's guide.

Another NSTA recent publication, *Decisions Based on Science*, despite its suggestive title, does not explore or clarify the values implicit in the making of scientific decisions. Instead it describes the use of risk-probability methodologies in making decisions. Unfortunately these methodologies are presented in a way that erroneously implies that they lend themselves to value-neutral decision making. With an appropriate supplement by the lesson maker this publication could serve as a useful resource for a lesson on the numerous ethics/values questions that actually arise when attempting to employ risk-benefit or cost-benefit analyses.

Techniques and Strategies for Ethics-in-Science Lessons

The twenty-three model classroom lessons we present in Part 2 illustrate several useful techniques or strategies that can be employed in the design of your own lessons. These include:

- The use of case studies. Students are given a brief scenario, or a set of brief scenarios, designed to illustrate specific ethical issues associated with science. These can be fictional or they can be based on actual events. After reading the scenario(s) students, either individually or in cooperative learning groups, are asked to respond questions designed to probe their ethics and values contents.
- The use of the "structured controversy." Students are divided into groups of two pairs. In each group the pairs are given one of two brief essays describing opposing views on a controversial issue related to science. After reading and discussing the issue among themselves the pairs engage in a brief debate in which they focus on the ethics and values differences that underlie the conflicting positions. The pairs then exchange essays and again debate, this time supporting the opposite position. The teacher rotates among the debating groups with the goal of keeping the debates focused on questions of ethics and values.
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Panel discussion. Students are given a description of a scientific dispute facing a community, as well as an outline of the positions likely to be taken by key parties to the dispute, governmental officials, and citizens groups. Students are then selected to represent the various parties and engage in a panel discussion, with the remainder of the class directing questions at the panelists. The entire class then engages in an analysis and discussion of the ethics and values issues raised by the panelists and questioners.

- Simulation. After reading a background essay on the some controversial new application of scientific research, students engage in a simulation of some real-life activity that requires them to make decisions with ethics and values implications about the ways society may choose to make use of this new technology.
- Ethics and values from science fiction. Students read a science fiction story that illustrates real life ethics and values issues related to science and technology. Either individually or in cooperative learning groups students respond to a series of questions designed to engage them in an analysis of the ethics and values associated with the choices made by the characters in the story, and to consider the ethics of the range of alternative actions open to the characters.
- Maintaining an ethics and values journal. Students are instructed to make weekly entries in a journal concerning the ethics and values issues described in science articles appearing in newspapers or magazines. The teacher periodically collects these journals, comments on them and selects one each week or two for classroom discussion.
- The "moot court." Students are given details of a case involving an individual who is being accused of some form of scientific misconduct. Students are assigned to play the roles of defendant, prosecuting attorney, defense attorney, judge and a series of witnesses for the prosecution and the defense. A mock trial is held with the remainder of the class serving as the jury.

Creative teachers will surely be able to think of many additional classroom teaching strategies designed to meet the goals of ethics instruction. No matter what techniques are used, an ethics lesson will almost invariably benefit from the inclusion of a significant time period for discussion of the issues among students. Teachers should confine their roles in such discussions to keeping things moving and focused on the ethics and values issues at hand. The stimulation of the moral

imagination and development of moral reasoning by students is generally promoted and enhanced by observing the differences and similarities in values and in modes of analysis employed by their peers.

A Few Words of Caution

The personal lives and experiences of students may be closer to some of these issues than we realize. Discussion of a debilitating hereditary condition may be painful for a student who has a family member or close friend who suffers from that condition. Children of scientists may be disturbed by suggestions that scientists aren't all scrupulously honest at all times. Discussing the ethics of various techniques used to enhance reproductive techniques may distress a student who has learned that he or she is some form of "test tube baby." This doesn't mean that such issues must not be discussed in class, but teachers should be sensitive to the potential personal impacts they may have on an individual student.

Finally, dogmatism has no place in ethics education. It is impossible and unwise for a teacher to try to hide personal feelings and thoughts on important ethical issues. Indeed, we should try to be good ethical role-models for our students. But at the same time we need to be scrupulous in encouraging open discussion of different moral perspectives among our students.

Suggestions for Analyzing Cases

Can an ethics discussion be more than a "free-for-all," especially if it is not the responsibility of teachers to provide students with the "correct" answers? We believe that it can--and that it should. A lesson plan typically will include a scenario (or case) to be discussed. As in any inquiry, it will be important to determine the facts that are given in this scenario as clearly as possible. It is also important to try to determine if there are possibly other facts (facts not presented in the scenario) that would be helpful in addressing the ethical questions.

So, one of the first things to do with students is to try to get as straight as possible about what the facts are that give rise to ethical questions, and to try to determine what other facts might be relevant to answering those questions. This may require hard, careful work -- for two reasons. First, the facts presented might be unclear or in need of further explanation; to understand some of them it might well be necessary to learn a fair amount about science. Second, not every fact that is mentioned may be *relevant* to the ethical questions raised. So, some attempt to

sort out the relevant facts from irrelevant ones is necessary.

Let's look at an example to see how this sorting might work:

Kim is one of the most popular students in her school and one of the smartest, as well. She has had all A's every semester since the 10 grade. Now she is a senior in her last semester.. Both John and Mark have invited her to the prom next month, and she is having difficulty deciding which invitation to accept. She likes both of them and does not want to hurt their feelings.

Usually, Kim concentrates very hard on what she is doing in her chemistry lab. She has been working on an important project for the past three weeks. It will count 25% of her grade. Until yesterday everything in the lab had gone quite well. Her project was nearly finished, and all the data she had collected pointed in the same direction. One more day in the lab would clinch it, she thought.

But receiving a second invitation to the prom yesterday morning took her by surprise. In the afternoon lab Kim seemed more concerned about what to do about John and Mark than in paying careful attention to her lab work. She finally resolved her problem that evening, but today presented her with a new one. Checking the results of yesterday's lab work, Kim found a set of results that did not fit very well with all the other data she had collected. Today was the day to write up her final report. She was worried that if she included yesterday's data her results would look a lot less impressive than if she simply excluded the data. She worried that this might result in her not receiving an A for the semester.

"I can't believe this," Kim thought to herself. "Almost three weeks of wonderful data, and now this -- on the last day of the project. I can't do it over, because the report is due tomorrow. Maybe I made a mistake in the lab yesterday; I could hardly think about anything other than John and Mark. So, maybe I should just leave out that data. After all, I have almost three weeks worth of good data -- and I *know* my conclusion is right.

Would it be all right for Kim to leave out the data from yesterday's lab work?

In reading this scenario we can understand why Kim is tempted to leave out the data. But we should not assume that the psychological factors at play here are relevant to the ethical question of whether she would be *justified* in leaving out the data. Whether or not Kim wears glasses, has blond or brown hair, or is tall or short

clearly have no relevance to the ethical question. Even if Kim were self-conscious about wearing glasses, having dyed her hair, or being very short or tall, this would not seem to have any relevance to the question of whether leaving out the data is justified. So, we should ask, what relevance does the fact that she was distracted by thoughts about John and Mark have to the ethical question?

By now it may be clear that to ask whether certain facts are relevant requires us also to ask what ethical concepts, rules, principles, or considerations are relevant to the case. So, the discussion needs to begin with two questions at once: 1) What are the relevant facts? 2) What are the relevant ethical considerations? In some cases, the answers may be relatively straightforward. In others, matters may be less clear and call for more extended discussion. Some of that discussion may pivot largely around what the facts are (e.g., what *is* the data from the study?), and we might want more information than the case provides. But what facts (known or unknown) we need to consider will, again, depend on the ethical issues at stake. Certain key concepts might also need to be examined. In this case, for example, it will be important to discuss what it might mean to *misrepresent* data, and whether *omitting* data is a form of misrepresentation. Further, is misrepresentation of data a form of *cheating*? Finally, we can ask what is wrong with cheating in a science assignment.

To give the discussion some structure, it might be useful to provide students with a set of tasks to perform. After reading the scenario, address the following questions:

- What facts are presented? (We can call these the *known* facts.)
- What ethical concerns do they raise?
- What are the key ethical concepts or principles that need to be considered?
- Which of the known facts are *relevant* to resolving the ethical concerns?
- What additional facts might be relevant to the case? (We can call these the *unknown* facts.)
- How might these unknown facts affect what is ethically at stake?
- What options are available?
- Which of these options seem best from an ethical point of view? Explain.

It is not intended that each question be addressed sequentially. It is to be expected that the discussion will move back and forth among the questions. However, it is helpful always to keep them in mind and to remind students of the importance of getting as clear as possible about each of them.

PART 2: Model Classroom Lessons

Introduction to Part 2 --- Including a printable taxonomy which characterizes the focus of each lesson and the issues with which each is concerned. ***This is a very valuable tool. Check it out!***

The following 23 lessons are designed for classroom use. They are all edited or revised versions of lessons created by teachers in our institutes. These lessons cover a wide range of topics and grade-levels. At least one lesson is included that is designed for each of the science courses commonly offered in secondary schools, including middle schools, junior high schools and senior high schools. Some of the lessons are adaptable for use in several subjects and grade-levels.

Each lesson conforms to the following format:

1. Title of Lesson.
2. The author(s) of the lesson.
3. Which science course(s) the lesson, as written, is designed for.
4. The kind of teaching activity employed in the lesson. (For example, a hands-on laboratory exercise, an organized student debate, a panel discussion, student responses to case studies, discussion of ethics issues involved in a science fiction story, etc.)
5. Which one, or more of the following categories of ethics-related issues best describes the lesson: Behavior of scientists, behavior of students, social issues, or honesty.
6. A listing of the principal ethics/values issues that are raised by the lesson.
7. A detailed lesson-plan, instructions for the teacher, and materials for the students.
8. A discussion of the appropriate use of the lesson, and the ethics/values issues that the lesson is designed to explore.

Lesson Plans

(Links to PDF of Lesson Plans)

1. Alas, All Humans
2. Student and Teacher Behaviors in Science Classrooms
3. Keeping a Science Journal
4. Honesty in Reporting Research
5. What Kind of Research Should Our Government Support?
6. Low Birthweight Infants
7. Fraud in Science: Circumstances and Consequences
8. Recycling
9. Dune Road
10. Summer Home
11. The Landfill
12. Pinebarrens
13. The Automotive Plant
14. Ethics Issues From Science Fiction
15. The Envelopes
16. The Human Genome Project Structured Controversy
17. Whose Life Is It?
18. My Friend Linda
19. The Race for the Double Helix
20. Reporting Data
21. Ethics in the Science Laboratory
22. The Law of Inertia
23. Handling Discrepancies

Resource Type

Instructor Materials

Parent Collection

Ethics in the Science Classroom

Topics

Pedagogical Approaches

Case Study Method
Using Moral Theories in Teaching

Discipline(s)

Teaching Ethics in STEM
Research Ethics