Ethical Dilemmas in Science and Medicine

Ella Boyd

Introduction

All throughout the year as I teach science, students often ask questions about the "correctness" or "fairness" of certain issues. Scientific "progress" sometimes involves making decisions that adversely affect the health or well-being of individuals or groups of individuals. There are big questions about who has the right to make decisions about an individual. I teach middle school science, seventh graders specifically, and students this age usually see things in black and white only. If you ask them, "why?" in response to an opinion or comment they might have, their response is usually "just because." I want students to go beyond "just because" to informed, thoughtful decisions or at least to thoughtful discourse even if a decision is not made. I hope with this unit to be able to teach students to look at both sides of issues and to form opinions after hearing more than one side of an issue. I also want them to understand that not all issues have a clear resolution.

How do we decide those issues that do not seem to have a clear resolution? Who has the right to decide those issues? There are many moments in history where the ethics involved in the pursuit of knowledge have raised serious questions. As part of the seventh grade science curriculum, two of our primary units are the study of the human body and genetics. While I will go back in history a couple hundred years or so for part of this unit to relook at a controversial issue, I will mostly be focusing on current issues that my students will no doubt be exposed to in just a few years. There is a long, sometimes grisly history, in the quest to understand the workings of the human body. While the basic anatomy of the human body has now been identified and mostly understood for hundreds of years, there still remains great mystery to the workings of our genes.

We are now at a point in history where ethical dilemmas are just as profound as they were hundreds of years ago, maybe even more profound and morally unanswerable. These kinds of topics are difficult to teach to middle school students who are in the vey early stages of learning how to evaluate ideas that have no defined answers. My primary strategy in teaching this unit will be to use the Socratic seminar, about which I will go into great detail in my strategies section. The historical issue we will look at first is that of grave robbers who robbed graves to provide fresh cadavers for medical students. While I originally believed this practice to be past history, I now know that it is a current issue in parts of the developing world. I plan to use this as an introduction to the human

biology unit. I want students to have a sense of the controversy that existed then and has existed since in the pursuit of scientific knowledge, particularly the pursuit of medical knowledge. One of the texts used in this part will be a passage from *Experiment with an Air Pump* which describes secret human dissections. Students will also be reading an article about grave robbers in the nineteenth century. A piece of artwork depicting a grave robbing scene from the nineteenth century will also be used here to aid in discussion. The current issues we will be discussing include DNA testing, "designer babies," and cloning. Another passage from *Experiment with an Air Pump* discusses one of those issues. These science topics will be elaborated on in the classroom activities section.

The vehicle for discussion I will be using is a strategy called the Socratic seminar which is a method for teaching students to create dialogue about issues. It is not the same as a debate where one side "wins" an argument. Open-ended questions are posed and students learn to listen respectfully. An exchange of ideas is the goal, rather than a correct answer. One of my goals with this unit is to become more of a facilitator and less of an instructor and let the students be in control of their own learning process.

The primary texts that will be used with this unit are excerpts from several plays and articles that raise questions about ethics and morality. All texts being used lend themselves to questions about the ethics or morality of certain decisions. I will be using *An Experiment with an Air Pump* and several stories from *Guinea Pig Scientists*. There are also several articles from *Current Science* on gene testing, cloning, and gene mending that I will be using to first initiate the idea of Socratic seminars.

Objectives

My particular school is a sixth through eighth grade middle school with approximately 1200 students. I teach on an A day/B day block schedule, which means that I have 3 block classes on A day and 3 block classes on B day. In our district, middle school students have science and social studies on alternating days. This schedule allows for longer class periods, which is ideal for a science teacher. Class is usually 75 to 80 minutes. I typically have 26-32 students in a class, for an average total of 160 students. Middle school science classes in my district are heterogeneously grouped, which means that I can have the highest achievers, the learning disabled, and ESL (English as a Second Language) students all in the same class. Science in seventh grade is no longer a state-tested subject, so I have a lot of flexibility in how I teach and the amount of time I can give to specific topics. While I am still expected to cover the standard course of study topics, I am not held as rigorously to a rigid pacing guide as other curriculum areas may be. This allows me to explore content in a way that I might not otherwise have been able to if I had to adhere to a specific number of days for each topic.

The state standards this unit will address will include goals from science and language arts. An overarching goal in all levels of science is that students will design and conduct investigations that demonstrate an understanding of scientific inquiry. According to the National Science Standards an inquiry based program is meant to nurture a community of learners as well as orchestrate discourse among students. Ultimately, the goal of the Socratic seminars used in this unit will be for students to dialogue in a meaningful way with each other. Another part of the inquiry goal is for students to develop a relationship between evidence and explanation. Their ideas and opinions need to be backed up with evidence from the texts they are using. Oral and written language need to be used to communicate findings and defend conclusions. The two other standards that will be addressed specifically are an understanding of the human body and an understanding of heredity. As part of our human body unit, students will look at issues that affect health and well being and will be given opportunities to discuss factors that may influence their health. As students learn about heredity, there is always a great interest in possibilities concerning our genes, and nature versus nurture kinds of questions.

There is a lot of crossover between the middle school content standards; so much of this unit will be an integrated one. Because a large part of this unit will have students using text to respond to issues that have multiple sides, the language arts standards fit very closely with what we will be doing. In seventh grade, two of the main goals are geared towards students responding to social, cultural, and historical issues and to understanding and using argument while respecting others' opinions. These goals will fit perfectly with my main strategy of Socratic seminars.

The Sciences

There are several issues I will be engaging my students with during this unit. I want to give them a bit of a background on what is already possible in science and what is being researched and could be possible in the near future. Here is a brief overview of the sciences about which we will dialogue.

"Designer Babies"

"In 2004 the term "designer baby" made the transition from sci-fi movies and weblogs into the Oxford English Dictionary, where it is defined as "a baby whose genetic makeup has been artificially selected by genetic engineering combined with in vitro fertilization to ensure the presence or absence of particular genes or characteristics."[1]

Designer babies, first of all, is a term that has been used by journalists and is not a term used by scientists. It first began to be used about a decade ago after the cloning of Dolly the sheep. The media began to imagine the possibilities for humans after this

historic birth. The idea that this technology might be used with humans began a slew of articles concerning how it might be used.

The actual term for this process is Preimplantation genetic diagnosis (PGD). It is also called reprogenetics, which is the combination of reproductive and genetic technology. The intent of this process is to screen embryos to detect the possibility of an inherited disease. Embryos are selected to implant in a mother's womb based on the absence of specific disease causing genes. This is a technology already being used specifically for this purpose. It is not the modification of an embryo's genes. It is just the selection of specific embryos for implantation. There are currently about 170 different conditions that are screened for with this technology. Cystic fibrosis and some hemoglobin disorders, such as hemophilia, are the most common diseases screened for.

There have now been a couple of cases where parents have screened for the genes that may lead to certain types of cancers. However, with this technology to detect disease lies the possibility of choosing embryos based on other characteristics, the most basic characteristic being the sex of the baby. While some parents have chosen to use this technology to choose the sex of the baby because of specific genetic disorders found only in males for instance, there are already doctors willing to screen and implant embryos based on the sex of the child only. This would seem to be the first step toward choosing other characteristics for a child, such as IQ, hair color, eye color, athletic ability, height, etc.; hence, the term "designer babies." It seems we continue to draw a line based on the protestations of many, but the line continues to be stepped over and a new line drawn. The premise of the1996 movie, *Gattaca,* seems to become more and more of a possibility with each new line crossed.

Cloning

While cloning became big news in 1996 when Dolly the sheep was introduced to the world, the first cloned animal, a frog, actually occurred in 1962, almost forty years earlier. The hype over Dolly is that she was the first mammal cloned from an adult cell, rather than from an embryo. There were 277 attempts at cloning a sheep before Dolly was successfully born. Dolly died a premature death, as have many of the other animals that have been cloned, which raises questions about the safety of human cloning. There are groups who have claimed to have produced a human clone, but no evidence has ever been provided for such claims.

Other than the great health risks that are possible (probable) in human cloning, there is the basic question of "Why?" There have actually been couples that have attempted to have a deceased child cloned, but there are so many ethical dilemmas raised with that possibility. The complex questions of nature versus nurture would be very evident with

trying to clone in order to "replace" a lost loved one. Environment has a great deal to do with the way an individual develops.

Cloning is a topic most students find very interesting, but they have great misconceptions about it. The biggest misconception is that if they were cloned, they would immediately have an identical twin. They do not realize the clone goes through all the necessary developmental stages of normal growth and would actually be thirteen years younger than them. As these students reach adulthood, cloning will become a regular issue that is discussed and debated with more urgency.

History of anatomy studies

Learning about the inner components of the human body and the function of those components has a long, fascinating, and sometimes grisly history. Humans have been peering inside of other humans for thousands of years. There were periods in history when public dissections were even considered acceptable for public viewing. There were also periods when it was absolutely forbidden and had to be done in great secrecy. As modern medicine began and thus the training of physicians became necessary, there was great need for cadavers for anatomy lessons. In England and the United States, medical schools were allowed to use the bodies of executed prisoners for research. That was not enough to meet the demand for a growing medical profession, so medical schools resorted to using grave robbers, also known as "resurrectionists," to procure fresh cadavers for dissection and study. The consequences for stealing bodies could include jail and/or execution. Some places tended to overlook it. Authorities eventually realized they needed to change the laws to allow for scientific discovery. Students will be reading the "Anatomy Act of 1832" which made it legal to obtain bodies for medical study, but describes previous criminal activity prevalent before the law was passed.[2]

Although grave robbing has been long since thought to be an issue of the past, it is still a problem in some developing countries where they still struggle to have enough cadavers for the medical schools. Many of these schools just cannot afford to supply their students with enough skeletons for study. Some students themselves have resorted to grave robbing in order to have the materials they need to be prepared for exams. [3]

Strategies

The Socratic seminar

Elder and Paul (1998) write, "Questions define tasks, express problems, and delineate issues. Answers, on the other hand, often signal a full stop in thought. Only when an answer generates a further question does thought continue its life as such."[4] It is my hope

that this strategy typically only used in language arts classes will generated higher level thinking skills with my students.

The primary strategy that will be used in this unit is the Socratic seminar. Socratic seminars are based on a model of teaching used by the philosopher Socrates, who believed it was more important for students to think for themselves, rather than be given a head full of "right" answers. Questions, not answers, are the driving force in thinking.[5] Ideas and values are drawn from various texts and dialogue, not lecture, is the central theme of the classroom "lesson." Scientific inquiry, which has been considered the best methodology for teaching science for the past decade traces back to the Socratic method of teaching. True inquiry allows students to derive meaning from activities in science, rather than the "cookbook" kinds of labs most teachers are comfortable with.

There are four interdependent elements in a Socratic seminar. These four parts when used correctly create a unique learning experience for the participants. The elements include the **text**, the **question**, the **leader**, and the **participants**. Seminar **texts** should be chosen their ability to facilitate extended and thoughtful dialogue. They are texts that may possibly raise as many questions as they answer. The texts that will be used for my class' seminars were listed above. I will go into detail about the specific parts of the text in the activities section. The seminar should open with a **question**. It should be a question that has no right answer and should lead participants to evaluate and clarify the issue that is involved. The question can be posed by the leader, or as participants gain more experience with the Socratic seminar method, they may pose the questions. The **leader** can play a dual role as a leader and a participant. The leader is to keep the dialogue focused on the text, ask questions that keep the dialogue going, but should never intervene with right answers. The leader may also find ways to draw out the reluctant participants and try to keep a reign on those participants who are way more eager to talk. The **participants** are responsible for reading the text before coming to class and must be ready with questions and ideas about the text. They must be ready to support their ideas with evidence from the text and they must be ready to respond appropriately to others' ideas. This involves active listening and responding respectfully. Participants are also expected to share in the responsibility for the quality of the seminar. [6]

The seminar itself can be done in one large circle with all students facing each other. The preferred structure is to have an inner circle and an outer circle. The inner circle will have ten minutes to discuss the text with each other. The outer circle is to remain silent and write responses to what the inner circle is saying. After ten minutes, the outer circle gives feedback to the inner circle and then they swap roles. Students who have not completed the pre-seminar tasks and are unprepared will not be allowed to participate in either circle.

Following the human biology unit, our curriculum moves into genetics and I want to use the questions raised in the previous plays to begin discussion about a more current

issue – stem cell research and "designer babies." By the time we get to this part of the curriculum, I hope to have established an environment where dialogue about ethical and moral issues is a comfortable place for the students to be. I believe this seminar will allow me to give students a broader perspective on the thought processes that go on behind decisions that are made regarding people's health. Once again, the use of Socratic seminars will help students to discuss and understand ideas, values, and issues regarding very current and controversial issues. In addition to the Socratic seminars, I hope to create a performance component to further enhance our discussions of "designer babies." I will either create scenarios for students to perform or allow them to create their own scenarios to act out regarding the ethical dilemmas faced with such possibilities.

As an introduction to the Socratic seminar, I plan to start with two short articles on controversial topics. With those articles, I will be using a strategy called "Ink Think." This strategy is currently used by language arts teachers in my school, so students should be somewhat familiar with it, but will now be using the strategy with science articles in my classroom. Ink think is a strategy that requires students to be active readers. They have a piece of text that they can write on and they respond with their thoughts, feelings, and reactions as they are reading. They make notes and comments on the reading in the margins and all over the paper. They may express surprise, confusion, familiarity, anger, disinterest, or any other feeling they have as they are reading the text. They may make note of language arts conventions as they read, such as pointing out context clues, comparison/contrast statements, hyperbole, etc. They will also be encouraged to write any questions the text may give rise to. Students are told to have no "naked papers." If students are using a text that cannot be written on, they can use post-it notes to record the same thoughts and feelings on the text. This strategy should make reading a much more interactive process and help lead to more questions and a deeper comprehension of the text.

Bioethics

Bioethics, by definition, describes social and moral issues that arise from the use of medical and biological research. The issues involved have risen dramatically in the last few decades because of the rapid rate of technological advancement. There are now entire courses on bioethics in medical schools. Much of what my students will be discussing with this unit are topics that involve bioethics. As a background for the ethical decision-making process, I am modifying the standards in the *Family Secrets'* module used in New York State to use as a guide for my own classroom. That process is listed below:

Work as a whole class to discuss the following:

1. Decide what is the ethical problem or dilemma.
2. Identify who is or may be affected by the problem.

3. Describe at least three possible courses of action.
4. Describe benefits and risks for each course of action.
5. Identify the ethics and values that support each course of action.

I will use this as a guide in getting my students ready for the Socratic seminars.

Classroom Activities

The classroom activities that will be part of this unit will be used over approximately two quarters, although all activities listed here will not be used in consecutive order. The activities will be interspersed into the regular curriculum across the two quarters. The first topic that will be part of this unit is the Human Biology unit and immediately following the completion of that study will be our study on heredity. The primary activities will be Socratic seminars, which will increase in difficulty of text and questioning as we go through the unit. The Ink Think strategy will be used in conjunction with the Socratic seminars as the pre-seminar work.

Lesson 1

Objective: Students will gain a background about the ethical issues faced in history and present time to gain knowledge of human anatomy.

As an introduction to ethical questions, I plan to introduce the human body unit with some history about grave robbing and secret dissections. I will show the picture below which depicts a grave robbing scene in the eighteenth century. Before explaining what the picture is about, I will have students write responses, reactions, and thoughts about the picture. After getting oral responses to the picture, I will pass out two articles, one on the "Anatomy Act of 1832" and an article entitled "Modern Grave Robbers." After reading the articles and then writing responses, students will be asked to take a position on the necessity of grave robbing. I will also read a brief passage from *Experiment with and Air Pump* about secret human dissections. I will have three stations on three different sides of the classroom with the signs "Agree," "Disagree," "Undecided." I will ask the following series of questions and students will have to move to one of the designated locations to show where they stand on the issue. After each question, I will have one or two students from each location to share why they decided the way they did. For the "undecided," I will ask them what additional information they would want to come to a decision.

Questions:
Is anyone being harmed by the grave robbers?
Should grave robbers who steal for medical schools go to jail?

Do you think real human bodies are necessary for medical students to learn with?

After students have responded to the questions, I will allow students to move to a different location if they have changed their opinion.

I hope by using this activity, I will start students thinking about taking a position and using evidence to support their position.

Lesson 2

Objective: Students will use the Ink Think strategy on an article about a human growth drug and discuss reactions to the article.

Students will use the Ink Think strategy to react and respond to a *Current Science* called "High Hopes." The article discusses the approval of a human growth hormone for healthy kids who are short. This will be students' first experience using the Ink Think strategy on a science article. After writing comments, questions, and any other reactions to the article, they will be given some leading questions about the article. To introduce the Socratic circle, students will be moved to be sitting in a circle facing each other. The leading questions are listed here.

Questions raised: Should any kind of drugs be used on someone who is not sick? Who should decide if being short is a problem? How much say do parents have in determining treatment for their children? Should children have any say in decisions about their own health?

After class discussion, students will write a reflection summary about the class discussion.

Lesson 3

Objective: Students will identify issues raised with cloning and dialogue about the pros and cons of this issue.

Students will read two separate articles on cloning, "Repeat After Me," a *Current Science* article, and another article about Dolly the sheep. They will use the Ink Think strategy to initially respond to the text and for homework will be required to complete a task prior to the Socratic seminar during the next class meeting. The rubric used for the pre-seminar task is found in Appendix 3. This will be the first attempt at trying the inner circle and outer circle activity described in my strategies section. After completing the seminar, students will be asked to reflect on their own performance in the self evaluation rubric found in Appendix 2.

Questions raised: What purpose could there be for cloning? What problems have arisen with cloning already? Should humans be cloned? For what purpose?

Lesson 4

Objective: Students will explore the ethical issues that are currently being raised with genetic technology that can produce "designer babies."

To begin this lesson, students will view the beginning scene from the film, *Gattaca*, where Vincent describes his natural birth, a "God child," and the birth of his brother who was selected from a set of embryos that had been prescreened to be free of disease and free of a propensity for obesity and other undesirable traits. The future world described in this film features "genoism," which is the term given to discrimination based on one's genetic makeup. Anyone with possible genetic abnormalities is relegated to the lowest of jobs and have no possibility of advancement. After viewing the film clip, students will read an article titled "Designer Genes." I will also read aloud a brief passage from Experiment with an Air Pump. The passage will discuss some of the issues raised here, but will also address the ethics of a company that has this technology but is only interested in a profit. Students will complete the pre-seminar work at home and be prepared for the Socratic seminar during the following class period.

Questions raised: How far should we go in determining the characteristics of an unborn child? Who is to decide what characteristics are desirable over others? Should embryos with known disabilities be allowed to be born? Should society allow doctors to make these decisions? Are our genes destiny? Will our future resumes be based solely on our genetics?

During the following class period, we will use the inner circle/outer circle format for the seminar.

Appendix 1

Oral Presentation Rubric : socratic seminar-inner circle

Teacher Name: **Ella Boyd**

Student Name: _____

CATEGORY	4	3	2	1
Preparedness	Student is completely prepared and has obviously rehearsed.	Student seems pretty prepared but might have needed a couple more rehearsals.	The student is somewhat prepared, but it is clear that rehearsal was lacking.	Student does not seem at all prepared to present.
Stays on Topic	Stays on topic all (100%) of the time.	Stays on topic most (99-90%) of the time.	Stays on topic some (89%-70%) of the time.	It was hard to tell what the topic was.
Listens to Other Presentations	Listens intently. Does not make distracting noises or movements.	Listens intently but has one distracting noise or movement.	Sometimes does not appear to be listening but is not distracting.	Sometimes does not appear to be listening and has distracting noises or movements.
Enthusiasm	Facial expressions and body language generate a strong interest and enthusiasm about the topic in others.	Facial expressions and body language sometimes generate a strong interest and enthusiasm about the topic in others.	Facial expressions and body language are used to try to distract.	Very little use of facial expressions or body language. Did not generate much interest in topic being presented.

Appendix 2

Socratic Seminar: Self evaluation

Name _____ Date_____

Seminar topic:_____

Please take the time to respond to the following questions about your preparation for and participation in today's Socratic seminar. Rank yourself with the following scores:

4 – was fully prepared and participated well
3 – was mostly prepared and had average participation
2 - only partially prepared and little participation
1 – minimally prepared and almost no participation

____ I read and responded to the assigned reading.

____ I took a position on the issues presented on the issues.

____ I backed up my position with evidence from the reading.

____ I made relevant comments during the dialogue.

____ I responded respectfully to others' comments

____ I connected the reading to my own experiences.

____ I formulated questions of my own that I posed in the seminar.

____ I stayed on topic during the dialogue.

Please finish the following statements:

I thought I contributed most to the dialogue by _____.

I wish I had said _____.

I think I could have been better at _____
_____.

For our next seminar, I want to be try to _____

Appendix 3

Pre-seminar tasks for _____ Name_____

Choose 3 vocabulary words that you are not familiar with or you want to highlight and define them. 1. 2 3
Write a brief paragraph about your general response to this article.
Answer the following questions about your reading. 1. Why is this an ethical issue? 2. Who may be affected by this issue? 3. Is this issue one that concerns you?
List 3 more questions that you thought of as you read this article.

Ball, Wanda H., and Pam Brewer. *Socratic Seminars in the Block*. Larchmont, NY: Eye On Education,, 2000.

This book has many sample lessons to look at and provides a good background on Socratic seminars.

Boring, Mel, and Leslie Dendy. *Guinea Pig Scientists: Bold Self-Experimenters in Science and Medicine (Outstanding Science Trade Books for Students K-12 (Awards))*. New York: Henry Holt And Co. (Byr), 2005.

Very interesting stories that could provide opportunities for good dialogue.

Copeland, Matt. *Socratic Circles: Fostering Critical And Creative Thinking In Middle And High School*. York: Stenhouse Publishers, 2005.

I found this book to be the most useful for understanding how Socratic seminars work.

Moeller, Marc V., and Victor J. Moeller. *Socratic Seminars and Literature Circles for Middle and High School English*. Larchmont, NY: Eye On Education,, 2002.

This book provide sample seminars using books and films.

Perkowitz, Sidney. *Hollywood Science: Movies, Science, and the End of the World*. Columbia: Columbia University Press, 2007.

Stephenson, Shelagh. "Act one, Scene two." In *An Experiment With An Air Pump (Modern Plays)*. London: A&C Black, 2003. 33, 52.

This book crosses two centuries and the ethical issues about science present in both eras.

www.biointeractive.org

Films:
Gattaca