“Ethics in Science, What’s the Big Deal?”

A study of the effects of biotechnology labs and analyses of case studies about science ethics on Forensic Science students’ knowledge and application of science ethics.

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Abstract: The purpose of this study is to describe the effects of biotechnology labs and analyses of case studies about science ethics on Forensic Science students’ knowledge and application of science ethics. Students will gain a basic knowledge of ethics in science through discussion and examples of real world science application of ethics. During a field trip to UF, students will gain hands-on experience working through biotechnology labs that a forensic analyst might encounter. After the trip, the classes will analyze and discuss several case studies involving real world issues that have occurred in the forensic science community. Data will be collected throughout this process using pre and posttests as well as student interviews to better understand if exposing the students to labs and case studies will more greatly enhance their knowledge and application skills when dealing with ethics in forensic science.

Rationale: I have chosen this path of research because ethics plays a part in everyday life and I believe that it does not receive enough classroom discussion. People often tend to think of a controversial topic such as abortion or stem cell research when they hear the word ethics. In science, ethics plays a vital role on the bench to bedside concept. Ethics provides rules of conduct by which scientists must strictly adhere to in order to maintain scientific integrity. Prior to this training I don’t think I had ever truly thought about how vital ethics is to the scientific method. Often times in schools we shy away from talking directly about ethics because of these notions about controversial topics. After hearing the talk from Dr. Moseley it occurred to me that we can steer away from the stigma of the term ethics and try to teach the idea of ethics in a different way, perhaps without even using the word ethics. When a scientist doesn’t follow the rules of conduct, there can be dire consequences. In a forensic science class it is important for students to understand how each department plays a part in the bigger picture. Dr Lampotang explained the Swiss cheese model. A particular system has many layers, like pieces of Swiss cheese. If each piece is turned in a certain way, it is possible that although a mistake could get through one layer of the cheese, it would be found and stopped by the next. However, if each layer is twisted a certain way, the holes in the cheese may line up and the mistake can go the whole way through. This is true with the case of Sutton and the Houston Police Department. More than one mistake had to occur in order for Sutton to be found guilty. One article focuses on how incidents and unit problems can cause a larger problem. It uses the case of Sutton as an example (Thompson, 2009).

My goal in teaching forensic science is to help students have a better understanding of the real science behind these television shows and entertaining factors that have gotten them interested in the topic. Students need to realize the difference between entertainment and the real world. I believe that by guiding them through some of the ethics of science my students will not only be better scientist, but also well-informed citizens. These students are potentially future jurors. If they are able to better understand the processes of both science and law protocols then they will be able to make a more well-informed decision for each trial. “Context information, such as expectations about what one is supposed to see or conclude, has been found to have a small but relentless impact on human perception, judgment, and decision
making (Saks, 2003, p. 77).” One simple misunderstanding is that there should be DNA and fingerprints on everything! The process is super simple, just scan the fingerprinting and boom, we have a match! Some of these misconceptions can be linked to the media. Television has helped to get people interested in forensic science but it has also done an injustice to some of the scientific methods that are needed to correctly handle and analyze evidence. One of the statements from Dr. Moseley’s lecture is that a person’s view should be able to change when new information arises. This is an idea that goes well with new technologies and new research techniques. As newer and more facts are presented on a topic, students should analyze this and decide rationally which position they would take. “Teaching ethics in science might increase the ethical knowledge of students. The arguments in favor of this are much the same as the arguments in favor of teaching any knowledge - in part that such knowledge is intrinsically worth possessing, in part that possession of such knowledge has useful consequences” (Reiss, 1999, p. 124). The word might implies that something is possible. I am conducting this action research to see if this possibility will be turned into a reality.

By working through a DNA fingerprinting lab and discussing the Houston Police Department case, students will be able to connect how ethics in science can affect the outcome in a forensic science scenario and find ways to avoid further misconduct and incidents in a forensic science setting. The purpose of this study is to describe the effects of biotechnology labs and analyses of case studies about science ethics on Forensic Science students’ knowledge and application of science ethics.

**Intervention:** I will be focusing the following interventions on my four forensic science classes. All students will participate in the analyses of case studies. Students will have the option of participating or not in the survey. I hope that this will provide me with more meaningful data so students aren’t just simply choosing a random answer, known as Christmas-treeing. Firstly, I will use Iowa University’s Bioethics site to engage the students in ethics discussions. This site provides several simple cases in which the students will need to use their prior ethical knowledge to determine the outcome. These situations and scenarios will first be answered individually and then discussed in small groups with the option of sharing their opinion with the whole class. This intervention will cause debate in the classroom and later be revealed how students are already able to make ethical decisions. It will also show that there isn’t always just one correct answer. The second intervention I will employ is a PowerPoint about ethics in general. With the upcoming political elections, there are many topics that the students will be knowledgeable about. These will be discussed lightly in respect to the ethics behind them. We will then need to define what ethics means in the science world. Having a basic understanding of how ethics affects the protocols and procedures in science is a support base for the students to have so I can then scaffold and add onto this information. This initial discussion will have parts from Dr. Moseley’s presentation from the Bench to Bedside training. In his presentation he discussed how opinions and positions can change when new information and facts arise.
This is important to science. Without an open mind and the ability to change opinions and positions then we would still all believe that the world is flat and that if we traveled too far, we would fall off. He also discusses how people seem to want a simple answer to a complex question, when in reality the solution should be just as complex as the problem in order to help solve it. I will also use the Swiss cheese model to help explain how small problems and errors can sometimes turn into larger problems. The first forensics case study will be on Ruby Ridge. They are going to read an online article and then discuss the ethical violations in one or two paragraphs. At this point the students should feel more comfortable with ethics than they did from the start. Through a PowerPoint and class discussion, we will go over interrogation techniques and tie this to ethics. To go deeper, students will be given an ethics position paper. They will be given background information about the 2001 attacks on the World Trade Center. This paper will weigh the importance of securing a confession against the implications of denying constitutional rights to certain criminals. They will be given some class time to start the project but the majority will be completed outside of class. Students will be given the opportunity to discuss their paper with the class as well as debate with other students over the ethical implications.

In addition to the in-class activities, I set up a lab visitation day at UF. I will bring 30 willing student participants to come to campus and go through several forensic science labs. One lab will be the southern blot. This was presented at the Bench to Bedside training. I believe this will be a lifelike scenario that the students can connect with. Students will be able to follow a specific protocol and instructions to try to determine who the killer may have been. This will give them a chance to recognize a biotechnology skill first-hand. Because we are visiting UF, we will have access to the necessary equipment to also complete a gel electrophoresis reaction. Students may have pre-conceived notions that DNA analysis is very simple and quick, when in reality this is not the case. Students who attended the field trip will have an opportunity to talk to their fellow classmates about their experience. They will give a short speech on what they enjoyed about the trip as well as if/how it has changed their view about ethics in science.

After the UF campus visit we will continue with several case studies. Several ethical issues can arise from DNA Fingerprinting. Bias is a very real issue in forensic science. Bias does not allow for scientists to simply focus on the results and to analyze them in an objective manner. I will couple a case study about the Houston Police Department with this lab. The Swiss cheese model is a simple way to help explain what happened in the Sutton/Houston Police Department case. That case study will then lead into discussion about the Innocence Project and wrongful convictions. The overall timeline for this unit will take about five, ninety-minute class periods for the in-class discussions. The visit to UF will be complete in one day.
**Data collection and analysis:** My goal is to give a pre-test prior to starting the ethics unit. This will help determine how students feel about ethics as well as their level of knowledge about ethics in science. Because I have 4 forensic science classes I believe that I can give them a choice of whether or not they want to participate in the survey. This will help to weed out those students who simply don’t care and would be skewing the data. All students in all four classes will still be discussing and participating in the ethics unit though. One survey will analyze whether they strongly agree-agree-neutral-disagree-strongly disagree. This will help me assess their attitude toward ethics. Sample questions may include: Do you think ethics plays a vital role in science? Given a particular situation, how important was the ethics in science to affecting the outcome?

In order to see the effects, I will also need to conduct a post-test. This post-test will be the same as the pre-test. In order to collect data, I will be able to compare their pre surveys scores with their post survey scores. This will allow me to see if the labs and case studies helped students to better gain a general knowledge of what ethics are and how they play a role in science, specifically forensic science. The survey will be analyzed and displayed using bar graphs. I will utilize our CPS clicker system and be able to print out a summary of the results. Because the bioethics discussion occurred on the first day of the ethics unit, I will give the students the scenarios again and see if their responses changed at all. I will then surprise them with their initial results and allow them to see if they changed their answer. If their answer or answers changed for specific scenarios, I will ask those students why they think they changed. Based on their answers I will look for common terms and analyze the knowledge items.

In addition to the pre-test I will also have student interviews with those students who attend the visit to UF. Students will be able to have lunch with me on specified days. These will be small groups so students can discuss with each other but also feel more comfortable to honest talking with me. These interviews will be occurring after the post-test has been given. I will be systematic in looking for patterns and common terms used by the students.

**Connections to Bench to Bedside:** The first connection would be through Dr. Ray Moseley’s discussion on *The Ethics of Biomedical Research*. This provides a basic understanding of ethics in science. The second connection is with the lab on southern blot. This is a lab Dr. Charles Lawrence spoke about during his *Classroom Simulations* presentation. The third connection to the Bench to Bedside training would be Dr. Lampotang’s example of Swiss cheese. Although he spoke about this in a medical setting, it can easily be applied to the realm of forensic science. The biggest affect Bench to Bedside will have on my action research is the ability to bring students to UF’s campus to show them science in a realistic setting that has high expectations for science integrity.
Literature Cited:


Budget: My $200 mini-grant will be spent on ordering the southern blot kit and paying for the UF visit.

Permissions: In order to attend the UF campus visit, students will have to acquire enough funds to attend (bus/lab fees) as well as a parent permission form. I will need to fill out the appropriate field trip forms at my school and have the field trip approved by my principal.