Case Studies and Methods for Teaching Professional Ethics for Forensic Science Students

Kelly M. Elkins[1]* and Ibiwunmi Fambegbe[1]

*[1]Chemistry Department, Forensic Science Program, Towson University, 8000 York Road, Towson, MD 21252, *corresponding author: kmelkins@towson.edu*

Abstract: Professional ethics education is an important and integral component of forensic science education and is included in the Forensic Science Education Programs Accreditation Commission (FEPAC) undergraduate and graduate program standards. Ethics is often confused with morals and values. This paper compares and contrasts ethics and morals and discusses approaches to teaching ethics with an emphasis on the case study method. A review of ethics resources for instructors and classroom teaching methods are discussed. Several case studies covering a wide range of ethical issues encountered in forensic science are included.

Keywords: Forensic science, ethics, morals, case studies, teaching methods

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Introduction

Ethics education is an important and integral component of forensic science education and is included in the Forensic Science Education Programs Accreditation Commission (FEPAC) undergraduate and graduate program standards (1). Ethics education is held as highly as exposure to forensic science disciplines, evidence analysis, law, quality assurance, testimony, and forensic science practice (1). Like the law, ethics education must be taught and coursework must include ethics modules.

The Forensic Specialties Accreditation Board (FSAB) accredits organizations that certify forensic scientists to ensure that the organizations meet or exceed their minimum standards which includes ethics standards (2,3). Certified professionals agree to uphold defined ethical and professional standards set forth by the Conformity Assessment Body (CAB) (2). Each organization also must have defined policies in the case that a certified individual breaches the ethics or professional standards (2).

Professional Ethics versus Morals

Professional ethics, morals and values are often mistaken for each other because each categorizes "right" and "wrong" or "good" and "bad" behavior. Professional ethics comprise professional norms and standards that can be defined by a code of conduct (4) whereas morals can differ from professional ethics. Synonyms for ethical include fair, good, conscientious, respected, reputable, scrupulous, unassailable, unimpeachable, and incorruptible. Morals or values can be governed by a culturally-conditioned, religious, or societal contract. An individual's moral standing can be described using the terms good, virtuous, righteous, upright, proper, just, noble, respectable, decent, high-minded, right-minded, upstanding, principled, clean-living, chaste, pure, blameless and sinless. The law dictates unacceptable or incorrect behavior and defines penalties for disregard or noncompliance. Moral and ethical individuals are considered to have integrity, be trustworthy and be law-abiding as demonstrated by the choices they make. However, there are actions that are not considered illegal but may be unethical (5). A CAB will have policies for dealing with breaches of its defined code of ethics or professional standards (3).

Ethics Resources for Instructors

There are many resources available to forensic educators teaching ethics courses and modules. These include peer-reviewed journal articles, textbooks, YouTube videos, interactive videos, handbooks and web resources (8-20) as well as the links cultivated by the American Chemical Society (ACS) Committee on Ethics (ETHX). Many of the sources include case studies for teaching and learning. Online courses such as the Collaborative Institutional Training Initiative (CITI) Biomedical Research courses are invaluable for training new researchers on research ethics and working with human subjects and specimens (6). The Office of Research Integrity (ORI) of The U.S. Department of Health and Human Service (HHS) created "The Lab: Avoiding Research Misconduct," an interactive role play video with

feedback on each selected action in the skit (7). Lockheed Martin has created a set of case training videos called "Voicing our Values" that frame values and ethics issues (20). An instructor can choose to use one or more of these resources to teach the professional ethic concepts integral to their course.

Teaching Methods

Instructors employ many methods to teach ethics including lectures, presentations, videos, online courses, case studies, clickers, polling apps, mock cases, reading assignments, writing assignments, skits, discussions, and student presentations. Presentations, case studies and clickers were used to teach ethics to American Chemical Society (ACS) members and meeting attendees at several national and regional venues. (Disclosure: KM Elkins is an ACS member and has attended these sessions.)

The case study method makes use of an instance when the topic under consideration or a related offense has occurred and promotes active learning. Real scenarios have been found to make learning more concrete (9) and disclose implications and actions resulting from unethical behavior (11). Since there been many cases in which ethical breaches have been found to occur, evaluating these in a systematic manner in comparison to ethical standard and codes of conduct can help students to recognize ethical breaches when they occur (9,11).

TABLE 1 Ethical issue response items from a 2019 national survey to ACS members

ISSUE
Accountability (institutional transparency, systems for reporting concerns)
Assignment of credit (authorship, inventorship, blame)
Conflict of interest (competing self-interests, biased research design or interpretation)
Data integrity (fabrication, falsification, plagiarism, reproducibility, misuse of statistics)
Data ownership (employee/employer claims, data reuse, open access)
Employment (job availability, searching, opportunity for advancement, compensation, visas)
Environmental stewardship (sustainability, contamination, animal care, dual use research of concern)
Intellectual property (record-keeping, patents, trade secrets, copyright, confidentiality)
Peer review (anonymity, personal or professional bias)
Regulation (review boards, risk assessment, labeling, pricing)
Research funding (grants, investment capital, R&D spending)
Respect (discrimination, harassment, teamwork, supervisor/supervisee relationship)
Safety and health (workplace hazards, employee training, auditing)

The ACS Committee on Ethics surveyed the ACS members in 2019 on ethical challenges they may encounter or have encountered in their careers (21). (Disclosure: KM Elkins is a Member of the Committee and contributed to writing the survey questions and responses.) Categories of ethical issues that were included as response items in the national survey are listed in Table 1.

Case Studies

Since case studies have been demonstrated to be an excellent method to teach ethics, we identified relevant case studies for use in teaching ethics in forensic courses. Using the categories of ethical issues used in the ACS survey, we report case study examples of each category. Most cases involve forensic science or forensic scientists. In many cases, more than one ethical issue was breached but we predominantly highlight one case each to exemplify the issue.

Accountability: It is the responsibility of employees and their supervisors to complete their assigned tasks to fulfill the goals of the institution. In public forensic labs, this also means being accountable to citizens and taxpayers. In addition, it is the responsibility of the institution to have a fair system for reporting concerns.

> The Austin, TX crime lab was shut down because reviews of the lab showed that the lab director failed to adopt nationally recognized testing guidelines which would allow them to calculate more accurate DNA match statistics. Prosecutors became suspicious about the lab's performance when lab supervisor Diana Morales contradicted herself during her testimony in a sexual assault case. In the testimony, she arbitrarily multiplied a small sample size by 30. In addition, she had been in charge of a freezer that contained hundreds of DNA samples and had failed for six days, which put the samples at risk. An audit also revealed that former employees had made several complaints about Morales, as well as the lab's general testing procedures for several years but that those complaints had been dismissed (22).

In this case, the lab's system for complaints, remediation and training to industry standards was not adequate (23).

Assignment of credit: It is important to acknowledge publicly and fully the origins of scientific ideas and contributions in presentations, patents and published documents.

> In the initial submission of a paper to an international medical journal, the authors listed were associated with two different research

> institutions and a corporate sponsor. Following external review, a revision was requested. While the initial submission included an extensive description of the individual authors' contributions, the author list was amended in the revised manuscript "to comply with the requested revisions and with the International Committee of Medical Journal Editors' definition of authorship." Authors from the second of the two research institutions were moved from the author line to the acknowledgements leaving only the authors from the first research institution, a husband and wife team, and the sponsor. After further revision, the paper was accepted for publication. Upon inquiry by one of the senior authors from the second institution about the paper's progress in the review process, it became clear that they were not aware that they were no longer listed as authors or that the paper was accepted. Upon investigation, it was discovered that the second research institution had received government funding for the project. The journal placed the publication of the paper on hold until the author dispute was settled (24).

In this case, there were no legal ramifications per se, but, in some cases, one could be sued or fined for not giving proper credit. Journals have clarified rules for authorship in recent years. Guidelines can be found on journal websites and in their instructions for authors.

Conflict of interest: Conflict of interest cases usually involve a person who has two relationships that may compete with each other for their loyalty. For example, scientists may be loyal to their job (23,25), family (25), lab or country. Forensic scientists face potential context bias when they know the expected outcome and their interpretation is favorable to the law enforcement agencies that houses their lab (25,26). Attorneys can also face context bias.

> As an example, in Orange County, California, scientists lead the research but the lab is managed jointly by the County, sheriff's department, and the district attorney's office (23). Selected 1980s Orange County murder cases are being revisited as there is suspicion that crime lab workers "tailored their testimony to benefit the prosecution." Also in Orange County, the office of the District Attorney operates their own unregulated DNA database separate from the lab filled with profiles of offenders "in exchange for favorable plea deals" (23). Separately in New York City, Robert Shaler, former forensics director at the New York City Medical Examiner's Office, said, "I've never had a police officer tell me what to write" (23). He continued, "But I have friends where police told them to rewrite reports in a different way" (23).

Implementing case managers could help limit context bias by minimizing the lab scientist's exposure to irrelevant information (25). What is irrelevant will vary by discipline and case (25). Separating the lab from law enforcement agencies and attorneys could also reduce bias (23,25).

Data integrity: When data is falsified, changed or manipulated, whether accidentally or maliciously, its integrity has been compromised. Unfortunately, this is a common ethical breach in the forensics field.

> For example, Annie Dookhan, a forensic scientist who worked in the Massachusetts State Police Hinton Lab as a chemist deliberately manipulated drug test results by not testing drug samples (yet claimed she had and falsified records) and tainted drug evidence by mixing evidence so it would test positive for drugs when it was originally clean (27-30). In addition, she forged initials of colleagues on drug testing paperwork turning negative results into positives for narcotics (27-30). This compromised thousands of criminal cases and led Massachusetts to drop over 21,000 cases (27-30). She was arrested and charged with obstruction of justice and sentenced to prison (27-30). In a similar case, Kamalkant Shah, a lab technician at the New Jersey State Police "dry labbed" or faked his results in 7827 cases (31-33).

Data ownership: To use data from publications or reports for research, permission and access is needed. In addition, it is unethical to steal data and publish under one's name.

> In a case, Author A reported that an article recently published in a journal by Author B was stolen and should not have been published. Author A had previously submitted the article to two other publishers two years prior. As evidence, Author A provided PDFs of the previously submitted manuscripts as proof of ownership. The manuscripts were compared to the one Author B had submitted and, upon evaluation, were found to be very similar. Author B was contacted and explained the article had been given by the PhD advisor, who was deceased. In addition, Author B was a reviewer listed on the website of the second publisher Author A had submitted the manuscript to but the publisher could not determine if Author B had access to the submission. Faced with the evidence, Author B agreed to retract the paper. Author A asked that since the article had been peer-reviewed and accepted, the journal would publish it with Author A on the byline. As copyright is

> transferred by the authors and the revisions were presumably made by Author B, the authorship could not be directly transferred (34).

While this case study is similar to the case study on assignment of credit, this case addresses theft and attempting to gain ownership of another scientist's data without their permission.

Environmental stewardship: Dual Use Research of Concern (DURC) refers to research that can be judiciously foreseen to provide useful knowledge and information or can be misused to pose a significant threat to physical and psychological public health and safety, agricultural crops and other plants, animals, the environment, or infrastructure integral to national security. Drugs, drug delivery, biological agents and nuclear energy are classic examples of DURC that can be used in creating terror agents.

> The chemical weapon mustard gas developed by chemist Fritz Haber was used in warfare in World War I in 1917 (35-36). Soldiers in Ypres, Belgium exposed to the agent reported smelling a peppery smell and inflamed eyes; later they developed severe blisters, sores and began coughing up blood (35). In addition to its effects on soldiers, the gas contaminated their equipment and the environment and caused tens of thousands of war casualties (35). It was later found to have use as an anti-cancer agent and spurned the new field of chemotherapy (36). Yale University doctors Louis Goodman and Alfred Gilman noticed that soldiers that had been exposed to the gas had a low number of white blood cells in their blood and hypothesized that the chemical could be used to treat leukemia and lymphoma cancers (36). In 1942, they began their tests on a man with severe tumors in the lymph nodes (36). The treatment reduced the size and pain for his tumors (36).

DURC research may be considered unethical if the "bad" outweighs the "good". Publication of such research is evaluated by special committees such as the NIH DURC Committee and the National Science Advisory Board for Biosecurity (NSABB).

Intellectual property: Intellectual property is an achievement of production or invention as a result of creativity or research, to which a person can apply for a patent, copyright, or trademark or publish the results in a research paper or report. Once the contribution becomes a patent, copyright, or trademark, no other company or individual is allowed to make use of it without permission or payment. Published research should be cited when used as a basis for future studies and the authors should be credited. If the information is confidential, the information about the product or the research cannot be given out freely to other companies or used by an employee for their own purpose outside of the company. In forensics, casework data is confidential for some time until it is conveyed publically in court or other proceedings. There are circumstances and procedures for sharing confidential data related to cases so that it is used appropriately. Forensic databases may contain fingerprint or DNA data that needs to be secure and confidential. Additionally, specialized reagents for DNA typing may be considered proprietary.

> This first case exemplifies proprietary information in DNA forensics. For decades, there were two primary commercial suppliers of forensic DNA short tandem repeat (STR) multiplex kits: Applied Biosystems and Promega Corporation. STR kits on the market have different configurations of the STR markers. When STR DNA typing was first introduced in U.S. courts, the methods were not admitted as the STR primer sequences and validation data was not published. In response, Promega published the primer sequences in their STR DNA typing kits (37) and obtained many patents for their multiplex STR amplification technology. In contrast, Applied Biosystems resisted publishing their primer sequences stating that they are proprietary but both companies published their validation studies and several independent validations were published (38). Under protected court order, Applied Biosystems has revealed their primer sequences in at least 16 cases (38).

This second case exemplifies proprietary information and intellectual property in which ethics standards were not followed. Lanxess, a specialty chemicals company in Germany, accused a former chemical engineer of stealing trade secrets and sharing it with an associate in China. The product was yet to be released to the public and the former employee and his associate planned on building a reactor in China, where they would make a chemical to compete with what Lanxess planned to produce. Theft of the trade secrets of the product is unethical and a crime. A court in Germany heard the case and convicted the former employee of civil theft charges and ordered pay to Lanxess of about $200,000 (39).

Peer review: Peer review is integral to review of reports and evaluating research papers in all science, including forensic science. Issues of falsifying peer review to get the work done faster have been noted (19).

> Joseph Kopera was a firearms examiner with the Maryland State Police from 1991-2007. Police have

> discovered that "In at least some of his lab documents, Kopera forged the initials of a co-worker who ostensibly reviewed his work." This discovery has prompted a review of thousands of his other cases. When a sample of 32 cases were evaluated, forged initials were found six times (40).

The discovery of the forged initials led attorneys to question his credibility.

Regulation: Accreditation is an indicator of quality for forensic labs. Accreditation review can uncover laboratory errors, issues with testing and analysis procedures, and inadequate staff training. On the other hand, it can demonstrate that a lab has met accreditation requirements.

> In 2015, the Mayor of Washington, D.C. ordered a crime lab audit by the American National Standards Institute (ANSI) - ASQ National Accreditation Board (NAB) after the U.S. Attorney's office said it had discovered numerous errors the lab's DNA analyses (41). Following the audit, the crime lab was ordered to immediately suspend all DNA casework (41). The NAB concluded that the lab's procedures were "insufficient and inadequate." (41). The audit had criticized the lab's practices and said they were not in compliance with FBI standards (42). It also ordered the "revalidation of test procedures, new interpretation guidelines for DNA mixture cases, additional training and competency testing of staff" because the DNA analysis conclusions were deemed "questionable" (42).

Research funding: Research is important in the forensics field as in other sciences. Research has led to new innovations and ideas that have improved the quality of the techniques, methods and instrumentation now used in forensic labs. Funding is crucial to labs achieving research goals. When the government awards a grant for the purpose of research on a topic, it is expected to be used for that purpose. Actual results and data are expected and fabricating or falsifying data to fit the purpose of the grant or the research is unethical and illegal.

> In 2005, University of Vermont (UVM) researcher Eric Poehlman admitted to fabricating and falsifying data over a ten-year period on 15 federal grants worth $2.9 million. The case was investigated by the U.S. HHS ORI and the U.S. Department of Justice (DOJ) launched a civil and criminal fraud investigation. He was the "first researcher sentenced to prison for misconduct" and served a year and a day in federal prison, two years' probation, and agreed to pay $180,000 to UVM and $16,000 to cover the whistleblower's attorney fees. In addition, he was barred for life from receiving federal research funding. He claimed that he manipulated data because he felt pressure to maintain grant funding to support himself and his research staff (43-44).

Misconduct can upset public confidence in research results, lead to reduced funding for future projects and highlight inadequacies of peer-review in science.

Respect: At work, respect is important because most work is now done by teams. Racial and sexual discrimination are illegal.

> A retaliation and harassment complaint was filed by Donald Mikko, a former firearms branch director of the U.S. Army Criminal Investigation Laboratory (USACIL) against the lab's officials. He cooperated with investigations of misconduct and racial discrimination at the lab and resigned after over twenty years of employment. At the time, the civilian Director of USACIL was chemist Larry Chelko who oversaw "seven internal investigations and eight complaints filed against lab managers within a four-year period, including claims of racial bias, sexual harassment, fraud and assault" and has since retired. One of the cases centered on A.D. Bell, a temporary employee who is black. USACIL lawyer Lisa Kreeger testified that she overheard a manager make a racist remark about Bell. Bell was later passed over for a permanent position. Mikko backed Kreeger and said his boss didn't hire Bell on account of his race. Several other racism concerns were also brought up by other employees (45-46).

Theft: Theft is both unethical and illegal.

> In a case, Sonja Farak, a forensic chemist and drug addict working in Massachusetts crime labs at Hinton and Amherst, stole drugs from the labs and consumed them on a nearly daily basis while analyzing evidence for eight years (47). She initially used methamphetamine purchased drug standards and later used cocaine base, amphetamines, and LSD evidence at the bench where she tested samples and in a lab bathroom (47). She even made crack cocaine from cocaine samples from cases for her use (47). Her actions compromised the drug testing of several cases and led to the shutdown of the Amherst lab (47). She pleaded guilty in 2014 was sentenced to 18 months in prison for drug possession and evidence tampering (47). Over 7,500 cases with over 11,000 convictions that she worked on were dismissed (48).

Safety and health: Lab accreditation mandates employee training and workplace safety; these actions are verified by investigations and audits. An audit is carried out to evaluate the lab's performance, standard operating procedures (SOP) and equipment function. Laboratory safety breaches can expose scientists to "potentially deadly diseases and infections."

> Eighty-two incidents were reported and more than 40 incidents were investigated by the UK Health and Safety Executive at hospitals, private companies and Public Health England (PHE) from June 2015-July 2017 (49). Potentially lethal bacteria and fungi were found to have been handled without proper protection (49). Students were found to be working with live meningitis instead of a heat-killed version by accident (49). A scientist working with *Shigella* at a PHE lab became ill while another contracted *Salmonella* while working in a private lab (46).

Both *Shigella* and *Salmonella* are foodborne pathogens that have been used as biological threat agents in forensic cases (49).

Credentials: Misrepresentation of credentials and certifications on one's CV or during testimony in court is another common ethical breach in the forensics field.

> Joseph Kopera served as the head of the Maryland State Police Crime Lab Firearms Unit (50). In this role, he collected and then analyzed bullets, shell casings, weapons and other forensic evidence (50). Prior to that position, he worked for 21 years in the Baltimore Police Department's crime laboratory (50). After nine years, he was promoted to supervisor of the firearms and tool marks unit and also supervised the Integrated Ballistics Identification System (50). Kopera worked on criminal cases in Maryland's 24 jurisdictions as well as in Delaware, Pennsylvania and Virginia and at the federal level (50). He lied when he testified on several witness stands that he had a degree from the Rochester Institute of Technology in photo science or Aerospace Engineering or a Mechanical Engineering degree from the University of Maryland, all of which he did not earn (50). He also forged transcripts from the University of Maryland to prove his qualifications (50). When presented with this knowledge by state public defenders working with the Innocence Project, the analysis of every bullet and every weapon that had passed through Kopera's crime laboratory was called into question (50). In another case, Annie Dookhan, an employee of a Massachusetts forensics lab, was found to have lied about her credentials: she claimed to have earned a master's degree in chemistry from University of Massachusetts and a doctorate from Harvard (28, 51).

Being dishonest about receiving certifications from an organization or misrepresenting a certificate and embellishment is unethical and illegal constituting perjury punishable by the courts.

Translating Case Studies to the Classroom

While instructors can introduce ethics topics and case studies through lecture, additional methods can follow or supplant lecture to translate case studies to the classroom. Following presentation of a case, students could be asked questions for discussion. Credit can be assigned for participation. Alternatively, students can be assigned to present a case with a critique about which ethical standards were breached. Clicker questions can be embedded in the lecture and the instructor can show graphs of anonymous student responses. Student could be asked to research and present a case in the form of an oral presentation or a skit.

Conclusion

Ethics education is as essential for students of forensic science as instrument training, sample handling and quality assurance. All of this content must be taught by the instructor so that the student can learn it. The case studies exemplify ethical issues that have faced forensics labs in the chemical profession. The use of case studies has been demonstrated to be an effective method of ethics education. Ethical breaches have led to considerable cost and retesting. Although the cases represent a very small number of forensic cases over the years, it is our hope that, with education, the instances of ethical breaches in forensic labs by forensic examiners and managers decrease.

Acknowledgements

The authors thank Rodney Dixon and Jennifer Bresett for participating in interviews, the members of the ACS Ethics Committee and Susan Schelble, Patricia Mabrouk, Rosemarie DePoy Walker, Cynthia Zeller, Greg Ferrence, Keith Vitense, Steven Tait, Rainer Glaser, Kathryn Northcut, Alanna Krolikowski, and Kaidi Yang, for stimulating discussions on teaching ethics, and Susan Schelble, Rodney Dixon, and Cynthia Zeller and two anonymous reviewers for providing critical suggestions for improvement of the manuscript.

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