Ethics and Responsibility in STEM

Dawn Nelson

Saint Peter's University

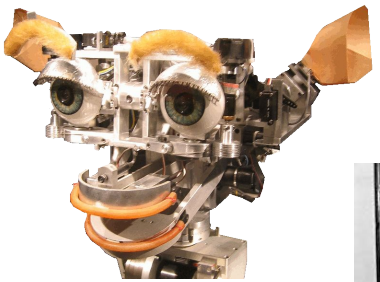
MathFest: Ethics in the Mathematics Classroom
August 1, 2019

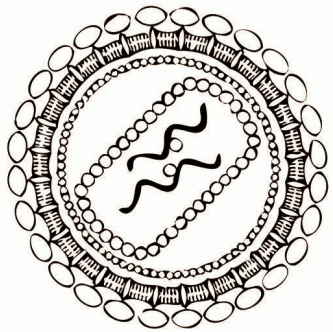
NS-320 Ethics & Responsibility in STEM

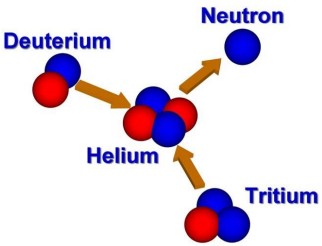
New Course
Spring 2017
values
writing intensive

Monday and Wednesday 8:30 - 9:45
Dr. Dawn Nelson

When faced with monetary, societal, political, environmental, and personal pressures, what choices should a researcher make?







We will examine issues faced by STEM practitioners in historical cases such as the “discovery” of cold fusion, the discovery of HIV, the Challenger explosion, the Stanford prison experiment, and the Algebra Project. Ethical issues may include publication standards, intellectual property rights, whistleblowing, conflicts of interest, human and animal subjects, robots, and diversity.

Image credits: Kismet (Jared C. Benedict), Cold Fusion (www.setthings.com/en/cold-fusion/), AIDS Virus (www.dibujalia.com/dibujos-virus-sida-1722.htm), Stanford Prison Experiment /www.prisonexp.org/), Space Shuttle (pixabay.com/en/space-shuttle-endeavour-shuttle-708635/)

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The University

Saint Peter's UNIVERSITY

The Jesuit University of New Jersey

- College of Arts and Sciences
- School of Education
- School of Nursing
- School of Business Administration

- 2,600 undergraduates (900 graduate students)
- Pell grant recipients: 61%
- Hispanic students: 43%
- NJ residents: 89%
- commuter students: 65%
- STEM majors (Bio, Chem, Comp Sci, Math, Physics, Psych): 36%

The Core Curriculum

60 Credits (Math Major is 47 Credits)

- Composition
- Literature
- Fine Arts
- Modern Language
- Theology
- Philosophy
- History
- Science
- Math

and.....

The Core Curriculum

60 Credits (Math Major is 47 Credits)

Writing Intensive course: follows a year of Composition courses,
ideally students learn discipline specific writing,
multi-draft paper required,
40% of grade from written components.

Learning Objectives (students will be able to):

1. Develop ideas in a clear, logical sequence with appropriate transitions;
2. Use language appropriate to the discipline explored in the class;
3. Demonstrate clear command of the mechanics of writing (i.e., grammar, spelling, diction, syntax);
4. Employ effective support materials (such as examples, statistics, charts, etc.) to elucidate more fully the overall intention of the paper;
5. Demonstrate understanding of the course subject matter through clear, lucid, and focused writing supported by appropriate evidence.

The Core Curriculum

60 Credits (Math Major is 47 Credits)

Values course: provide an opportunity for the student to attempt to bridge the gap that appears to exist between the world of facts, what merely is the case, and the world of values, what ought to be the case.

Learning Objectives (students will be able to):

1. Identify key philosophical, moral, and/or religious terms and concepts studied in the course.
2. Demonstrate knowledge of the moral and/or religious principles and normative theories studied in the course.
3. Apply moral and/or religious principles and normative theories to specific areas of human conduct.

Other “Values” Courses (offered Fall 2019)

1. Environmental Art and Issues
2. Cultural Anthropology
3. Business Ethics
4. Criminal Justice Ethics
5. Information Technology Ethics
6. Ethics in Communications
7. Literature of East and West Africa
8. Multicultural Literature for Young Adults
9. Contemporary Legal Issues
10. Legal and Ethical Issues in Sports
11. Philosophy of Law
12. Ethics of War and Peace
13. Old Testament Introduction
14. Theology and Contemporary Public Issues
15. Ethnicity and Race in Urban History

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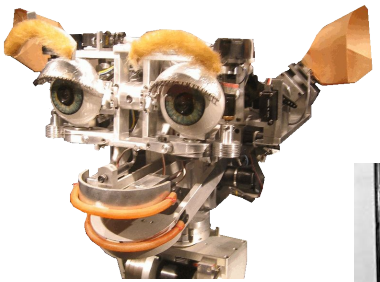

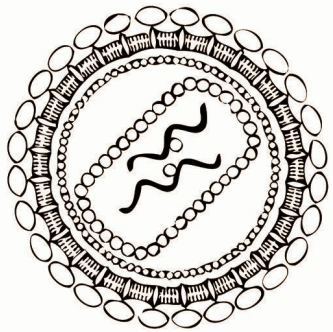

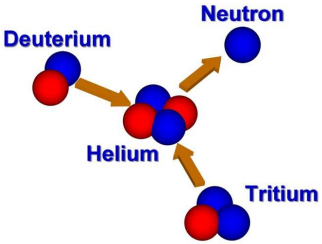

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Timeline

- Spring 2016 - Inspiration hit, discussed vague plans with mathematics department chair.
- Summer 2016 - Researched and designed course.
- Early Fall 2016 - Sought support and approval for course.
- Spring 2017 - Course first offered; 7 students (5 math majors).
- Spring 2018 - Second offering of course; 16 students (bio, chem, math, psych, physics).
- Fall 2019
  - section 1 (currently 12 students)
  - section 2 (currently 5 transfer students) - pilot Transfer Seminar

Challenge ONE

What is appropriate content?

Challenge ONE

What is appropriate content?

Solution: Google and internet rabbit hole...

initial references: graduate programs

Primary References

- University of Houston, Ethics in Science, Course Information: `http://www.uh.edu/ethicsinscience/Courses.php`
- Practical Ethics Center at the University of Montana with the Office of Research Integrity (ORI), Online Research Ethics Course: `https://ori.hhs.gov/education/products/montana_round1/research_ethics.html`
- UC San Diego, Research Ethics Program, Resources for Research Ethics Education: `http://research-ethics.org`
- (old version of) Dartmouth Ethics Institute website:
  - *The Ethics of Scientific Research: A Guidebook for Course Development*, by Judy Stern and Deni Elliott.
  - *Research Ethics: A Reader*, edited by Deni Elliott and Judy E. Stern.

Decision

Focus on responsible conduct of research.
Pair issues with historical cases.

- Methodology and Publication – Imanishi-Kari/Baltimore case.
- Peer Review and Publication – “discovery” of Cold Fusion.
- Collaboration, Competition, and Intellectual Property – Gallo (HIV) case.
- Institutional Responsibility and Whistleblowing – Challenger disaster.
- Conflicts of Interest – Council for Tobacco Research.
- Use of Human Subjects – Stanford prison experiment.
- Robot Ethics – programming artificial intelligence.
- Diversity in STEM – the Algebra Project.

Challenge TWO

How do I structure a non-math class?

How do I prepare for a discussion based class?

How do I help STEM students succeed in an atypical science/math class?

Challenge TWO

How do I structure a non-math class?

How do I prepare for a discussion based class?

How do I help STEM students succeed in an atypical science/math class?

Solution: Give myself and students scaffolding to hang chaos on.

Prepare lots of leading questions.

Let my curiosity be my guide.

Do NOT lecture on material I don't know.

Schedule of Class Meetings

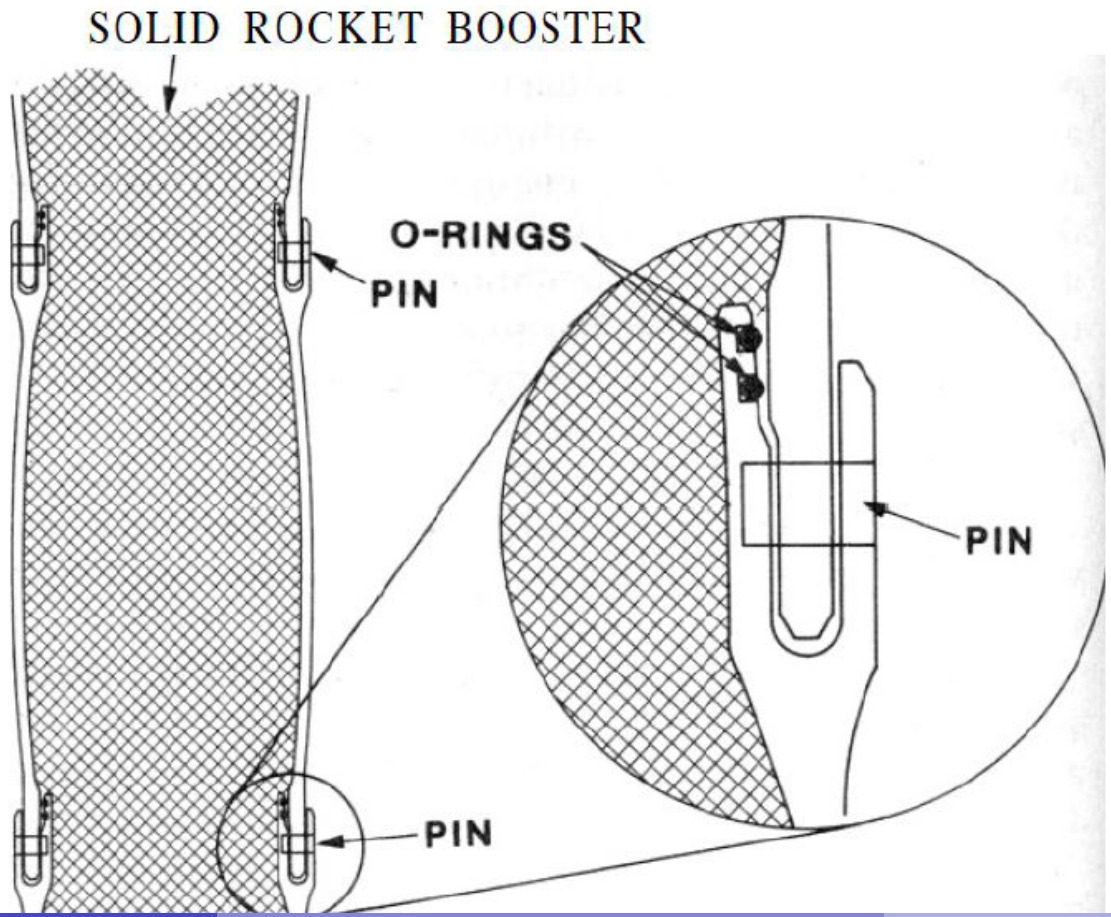
For each unit...

- 1-2 classes of film and faculty presentation of relevant traditional STEM content.
- 1-2 classes of student discussion focused on ethical issues.

Sample Unit: The Challenger Disaster

In-class video: *Challenger: The Untold Story.*

- video viewing guide: questions to think about as you watch.
- follow up discussion focused on causes of the disaster and the actions of the engineers.



Sample Unit: The Challenger Disaster

Reading: chapter "Deciding to Become a Whistleblower"

- reading guide:
  - definitions of unusual words
  - position statement prompts: "In 2-3 paragraphs (about 300 words) answer at least one of the following questions."
  - additional questions you may want to think about as you read.
- In class discussion focused on whistleblowing (when, why, how).

1. Does Bok's checklist align with one of our ethical theories (value ethics, utilitarianism, Kantianism)? Which one? Why?
2. Why did Roger Boisjoly fight so hard to report his concerns about the o-rings?
3. What would Kant say about Roger Boisjoly's decision to testify before the Roger's Commission?
4. What do you think about Bok's checklist? Is anything missing from the list? Is it realistic to think whistleblowers will use a checklist like

Challenge THREE

What are appropriate assignments for a non-math class?

Challenge THREE

What are appropriate assignments for a non-math class?

Solution: Get advice from faculty in other departments (especially humanities and social scieces).

Create/modify and use rubrics.

Coursework

- Independent reading assignments.
- Online reading quizzes: designed to ensure completion of assigned reading.
- Position statements: short paragraph reflections; one copy handed in for credit, another copy kept by the student to be used as in-class discussion starters.
- Participation
- Research Project
  - Multidraft paper
  - Presentation
- Tests

Rubric for Class Participation

Criteria	Level 1 (Unsatisfactory)	Level 2 (Developing)	Level 3 (Proficient)	Level 4 (Exemplary)
Active participation	Absent. Does not contribute.	Few contributions. Seldom volunteers but responds to direct queries.	Voluntarily contributes to discussion without prompting.	Actively and regularly contributes to discussion. Initiates discussion on issu related to class topic.
Relevance of participation to topic under discussion	Contributions are off-topic or distract class from discussion.	Contributions are sometimes off-topic or distracting.	Contributions are always relevant to discussion.	Contributions are relevant and promote in-depth analysis of material.
Evidence of level of preparation	Not adequately prepared. Does not appear to have read the material in advance of class.	Appears to have read the material, but not closely or did not read all material.	Clearly read and thought about the material in advance of class.	Consistently well-prepared Investigates and shares relevant material not explicitly assigned.
Listening/ Cooperation	Inattentive or makes inappropriate or disruptive comments.	Participates occasionally; Does not respond to contributions of others.	Participates regularly without monopolizing. Listens and responds to contributions of others.	Models good classroom citizenship. Listens withou interrupting. Responses to others are appropriate. Promotes active participati by others.

*Rubric created by Claudia J. Stanny (Center for University Teaching, Learning, and Assessment: University of West Florida) and adapted for NS320 by Dr Nelson.

Research Project: case study (not covered in class).

- Multidraft paper (individual)
- Presentation (groups of two allowed)

Define the ethical issues, evaluate the actions taken, and describe how an adherent to a chosen normative theory would act.

Intermediate checkpoints

- topic approval
- initial (partial) bibliography
- outline and expanded bibliography
- first draft
- final draft
- presentation

Paper Rubric

Quality of Written Work: See Writing Intensive Rubric for more details.

- ☐ [1-4] **Logic and Organization:** Unified and coherent ideas, organized logically with appropriate transition sentences. Clear and specific introduction and conclusion.
- ☐ [1-4] **Language:** concise standard English sentences and a variety of sentence structures.
- ☐ [1-4] **Spelling and Grammar:** carefully proofread.
- ☐ [1-4] **Development of Ideas:** supports ideas with a variety of effective examples, references, and details.
- ☐ [1-4] **Purpose:** decisions about focus, organization, style, and content support the purpose of the writing.

Content:

- ☐ [1-8] **Case Summary:** concisely identifies who, what, when, where.
- ☐ [1-4] **STEM terminology:** accurate and appropriate use of scientific language and terminology.
- ☐ [1-8] **Ethical Issues:** correctly identifies ethical issues and stakeholders.
- ☐ [1-8] **Ethical Arguments:** takes a position and justifies it in the context of normative ethical theories.
- ☐ [1-4] **Visual Aids:** if visuals (graphs, tables, diagrams, photos) are included, they are clear, pertinent and support the purpose of the paper.

Technicalities

- ☐ [1-4] **Deadlines:** meets all the deadlines.

Continuing Challenges

- Grading and giving feedback on written work.
- Fostering discussions between students.
- Tying ideas together within and between units.
- Reviewing and refreshing content regularly.

Student Feedback

Spring 2017

- 5 of 7 students“strongly agree” that they would recommend this course to others
- “This has been my favorite core course so far! I think all science majors should be required to take this course as their ethics core requirement.”

Student Feedback

Spring 2018

- 9 of 12 students “strongly agree” or “agree” that they would recommend this course to others
- “there was nothing valuable about this course. i didn’t take nothing from this course.”
- “i loved this class, from the stanford prison experiment to the robotics, this is going to be a class i’ll probably remember.”
- “Everything was awesome really love this class and the professor. Learned a lot and it managed to keep my attention for the duration of the semester.”

Select References

- Required Text: *Ethics and Science: An Introduction,* by Adam Briggle and Carl Mitcham. Cambridge University Press.
- Recommended Text: *Theories of Ethics: An Introduction to Moral Philosophy with a Selection of Classic Readings* 1st Edition, by Gordon Graham. Routledge.

Introduction

- Martinson, Anderson, de Vries. "Scientists behaving badly". *Nature*. June 9, 2005; 435. p.737-738.
- D. Resnik. "What is Ethics in Research & Why is it Important?" December 1, 2015. `www.niehs.nih.gov/research/resources/bioethics/whatis/`

Human Subjects and the Stanford Prison Experiment

- Gray. "Why Zimbardo's Prison Experiment Isn't in My Textbook." *Psychology Today.* October 19, 2013.
- M. Konnikova. "The Real Lesson of the Stanford Prison Experiment". June 12, 2015. `www.newyorker.com/science/maria-konnikova/the-real-lesson-of-the-stanford-prison-experiment`
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Robot Ethics and Artificial Intelligence

- Asimov, “Runaround”. *I, Robot*. 1950.
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Conflicts of Interest and the Council for Tobacco Research

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Videos

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- 60 Minutes. “Cold Fusion is Hot Again”. 2009.
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Thank you!