Teaching & Learning Academy

Teaching Engineering Ethics:

The Why, How, and What?

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UNIVERSITY OF WYOMING

Agenda

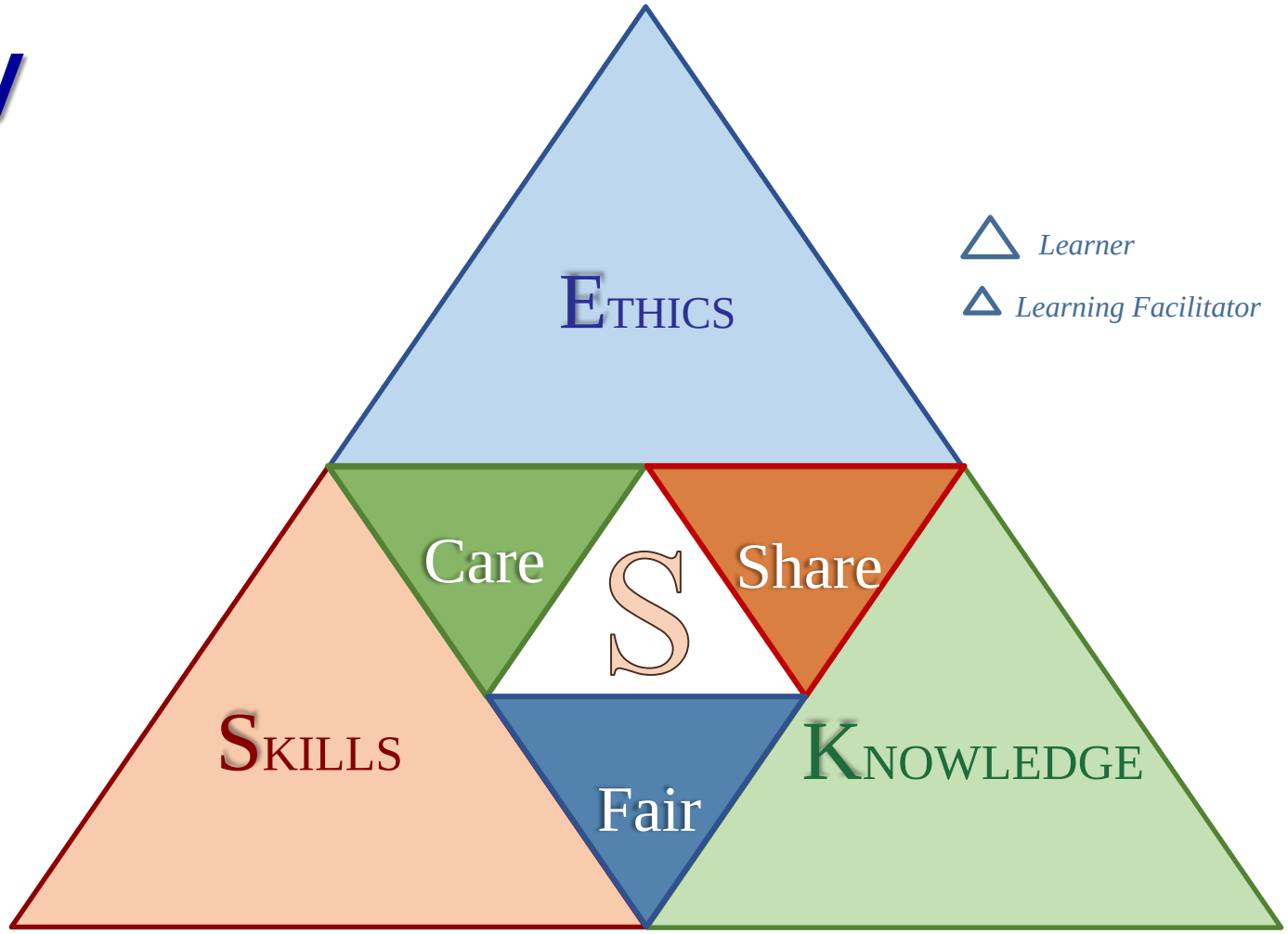
Why do we need to teach and learn ethics?

How do we teach and learn ethics?

What do we need to teach and learn in ethics?

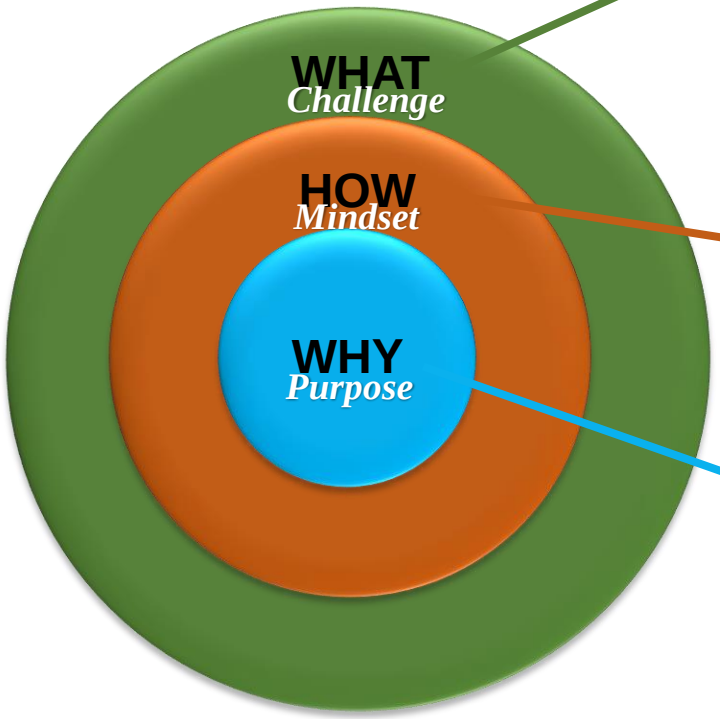
The Why?

Teaching Philosophy



"When we care, we share." — Jonah Berger, Contagious: Why Things Catch On

Start With Why?



Energy
to solve the energy
and climate challenges

Engineering
we engineer our
resources

Ethics
because we care
about our society

Similarities and differences between engineering disciplines

Start with Why: How Great Leaders Inspire Everyone to Take Action -- Simon Sinek

Why do we need to teach ethics?

Accreditation Board for Engineering and Technology (ABET)

- Student Outcome (4) an ability to recognize **ethical** and **professional responsibilities** in engineering situations and make **informed judgments**, which must consider the impact of engineering solutions in **global**, **economic**, **environmental**, and **societal** contexts.

Why do we need to learn ethics?

To become a Professional Engineer (PE):

- Earn a four-year degree in engineering from an accredited engineering program
- Pass the Fundamentals of Engineering (FE) exam
- Complete four years of progressive engineering experience under a PE
- Pass the Principles and Practice of Engineering (PE) exam

“It is better to aim high and miss than to aim low and hit.” – Les Brown

Ethics help you to aim high and hit.

People hire for skills and fire or promote for ethics

The How?

National Society of Professional Engineers
Code of Ethics for Engineers

Preamble: Engineers are expected to exhibit the highest standards of **honesty** and **integrity**. Engineering practice require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the **public health**, **safety**, and **welfare.**

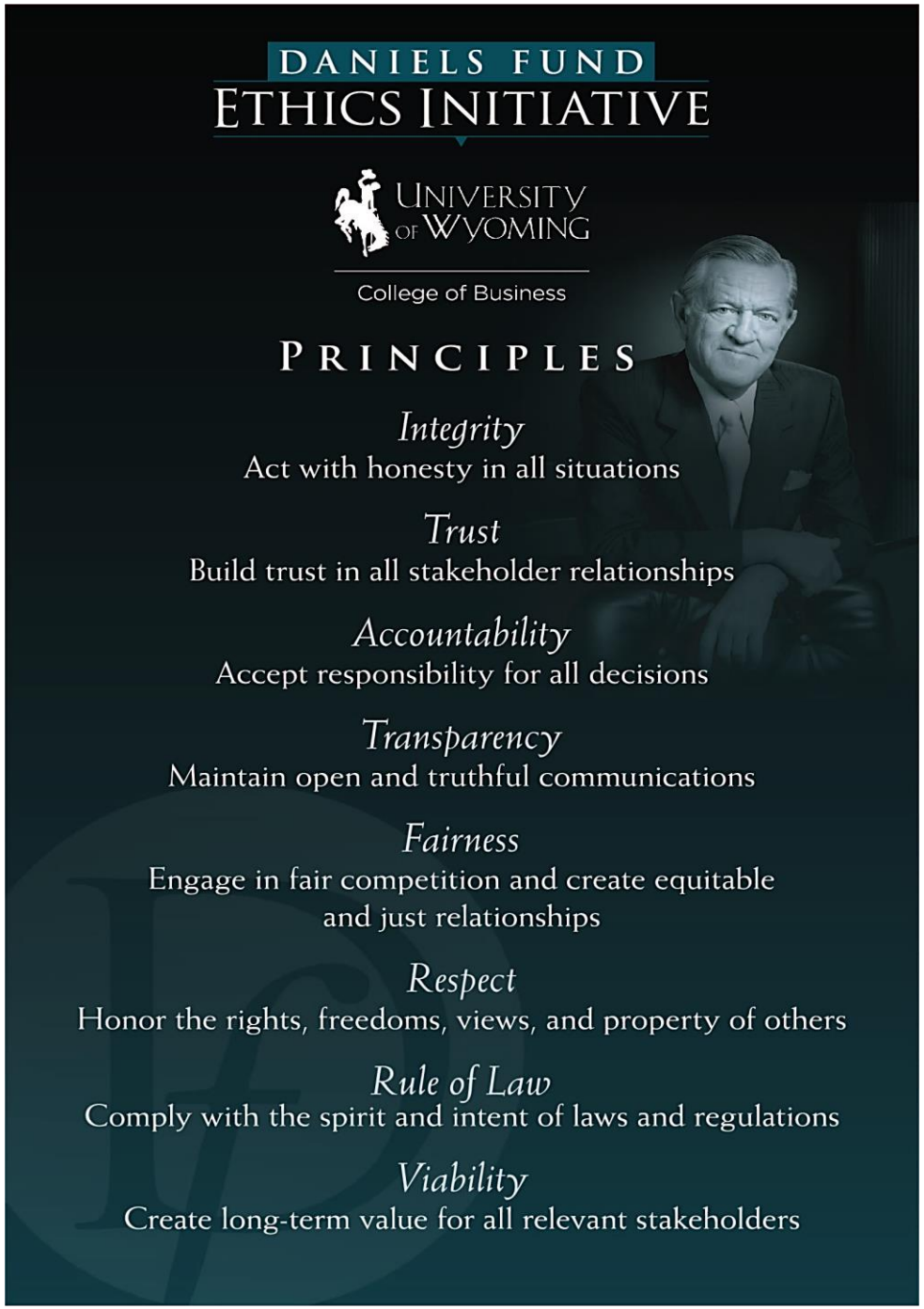
I. Fundamental Canons [6 Canons]

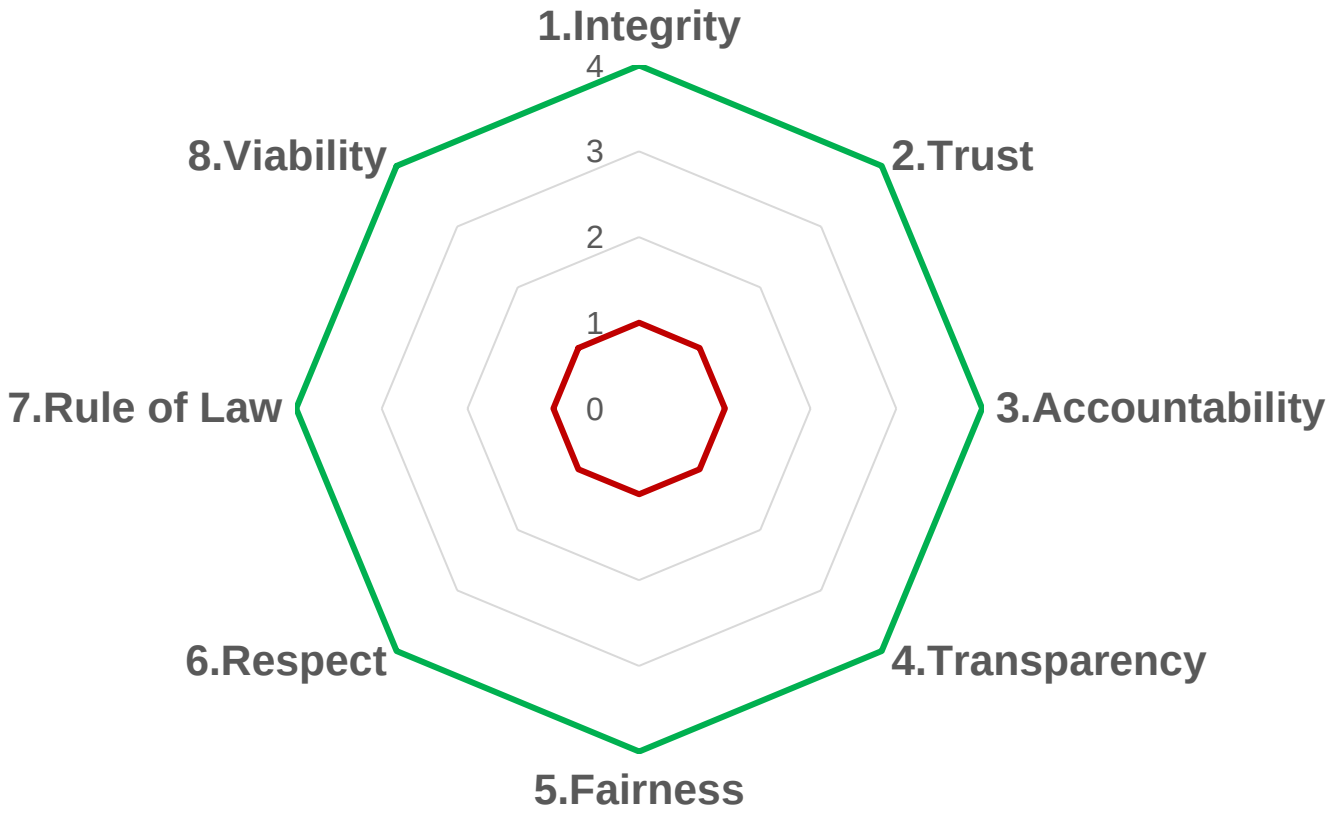
II. Rules of Practice [5 Rules or Dos]

III. Professional Obligations [9 Obligations with 19 subrules or Don'ts]

I. Fundamental Canons: Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the **safety**, **health**, and **welfare** of the public.
2. Perform services only in areas of their **competence**.
3. Issue public statements only in an **objective** and **truthful** manner.
4. Act for each employer or client as **faithful agents or trustees**.
5. **Avoid deceptive** acts.
6. **Conduct themselves** honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.





Daniels Fund honoring Bill Daniels' direction to make life better for the people and communities of Colorado, New Mexico, Utah, and Wyoming.

Teaching Engineering Ethics

HP 4151 Engineering, Ethics, and Energy in Honors College	PETE 3725 Wellbore Operations in Energy and Petroleum Engineering Department
• Renewable and nonrenewable energy resources and their ethical implications on society and global climate change	• Technical and ethical consequences of the plug and abandonment (P&A) operations in abandoned wells in Wyoming

Module Learning Objectives (MLOs)

1. Identify ethical issues in real-world scenarios
2. Practice ethical decision-making using ethical principles
3. Recommend professional actions to address ethical implications

Learning Activities and Assessment

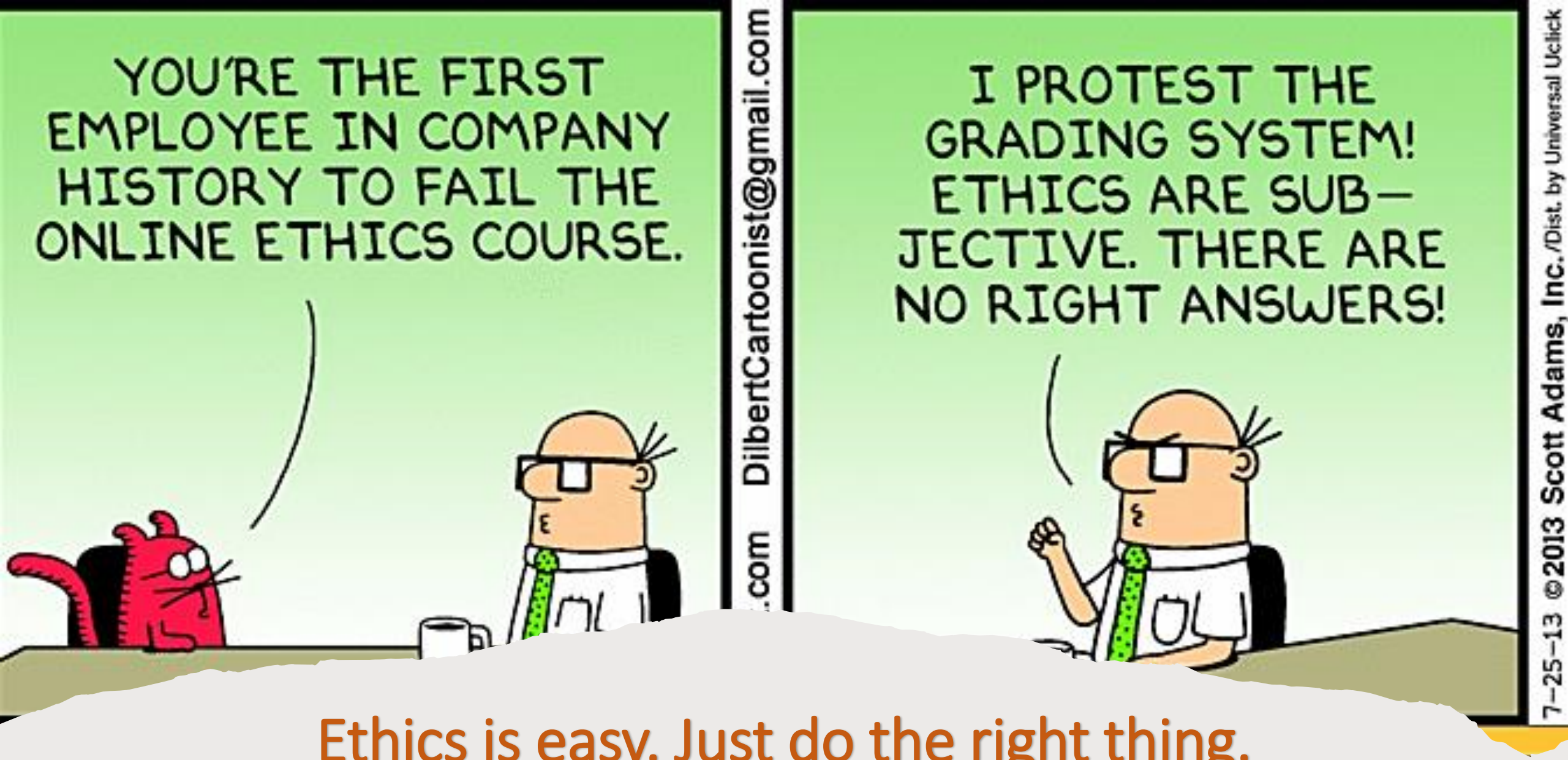
HP 4151 Engineering, Ethics, and Energy

- Four-week long learning module
- Reflection assignment on short and long-term benefits of applying the Daniels Fund Ethics Initiative principles
- Mapping NSPE and DFEI ethics frameworks
- Creating an ethical decision-making framework
- Wyocourses discussion thread of eight real-world scenarios
- Wyoming Society of Professional Engineers (WySPE) guest speaker
- Midterm research paper on engineering ethics

PETE 3725 Wellbore Operations

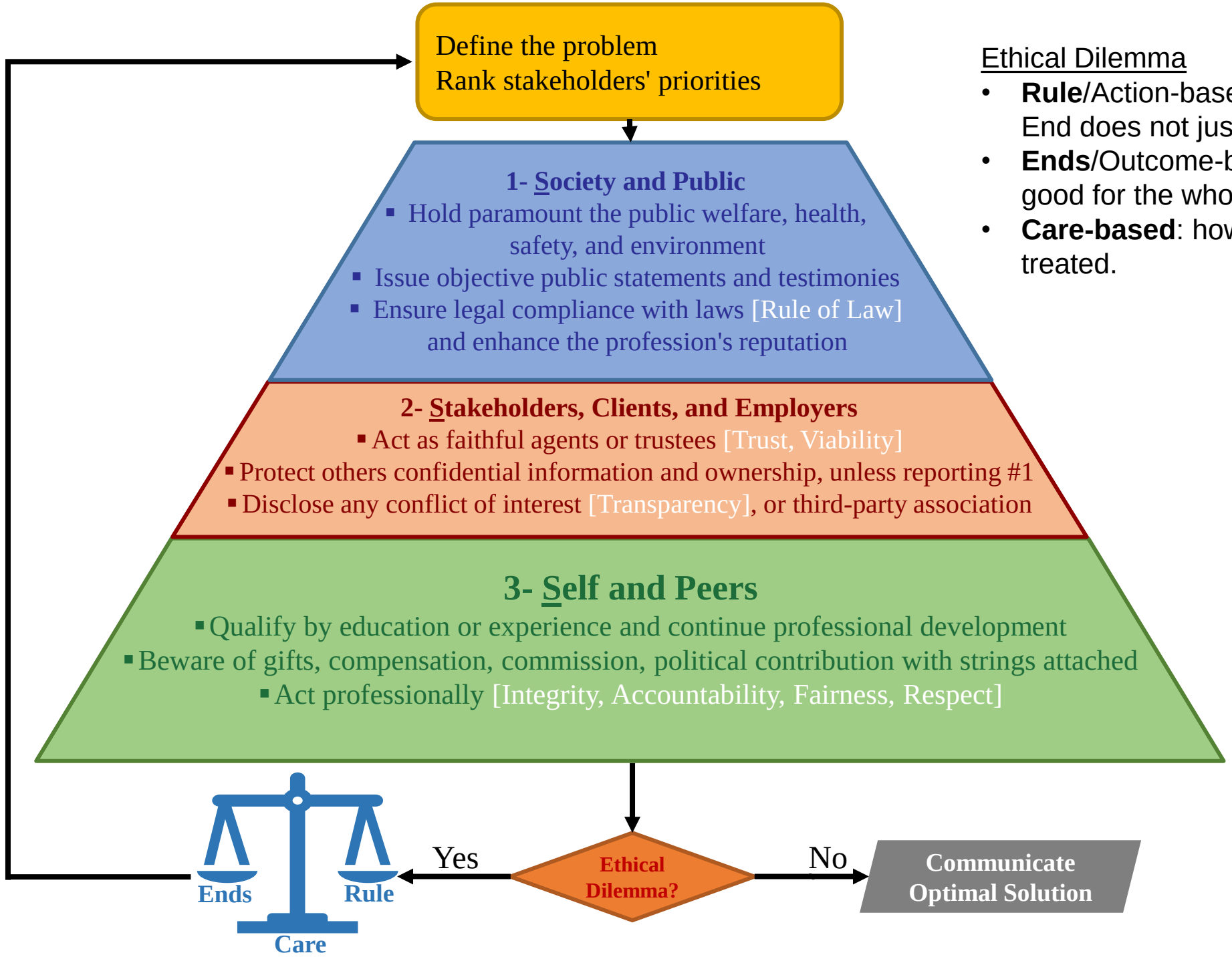
- Two-week long learning module
- In-class individual reflection and group discussion on DFEI ethics principles
- 15 multiple-choice questions Wyocourses quiz
- Oil & Gas Counsel guest speaker
- Four midterm multiple-choice questions
- Four final exam multiple-choice questions

The What?



Ethics is easy. Just do the right thing.

Okay, but which one?



Ethical Dilemma

- **Rule**/Action-based: rules are rules. End does not justify the means.
- **Ends**/Outcome-based: the most good for the whole
- **Care-based**: how do you want to be treated.

Case 5 – Energy Testimony

- **Engineer A** serves on the State X Environmental Quality Council. Another State Y conducts a hearing on proposed rules for coal bed methane discharge permits. Engineer A was retained to testify by a coal bed methane company.
- In State Y, **Engineer A** began his testimony by stating that he was a licensed professional engineer only in State X. He then stated that he is employed by the U.S. Department of Energy, working in the coal bed methane arena and his slides listed his job title with the U.S. DOE.
- Engineer A also provides consulting services for coal bed methane companies. He never stated in his testimony that he **works for coal bed methane companies**. When asked at the end of his testimony if he was testifying on behalf of the U.S. DOE, Engineer A said, "I am testifying on my own behalf."
- Later, a newspaper article on the hearing reports that a "U.S. DOE researcher" testified at the hearing, and information is later revealed that Engineer A's attendance at the hearing was **paid for by the coal bed methane company through his consulting business**.

Discuss:

- Was it ethical for Engineer A to provide expert testimony in the manner described?
- Was it ethical for Engineer A to serve as an expert witness under the circumstances?

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Discussion

Given 10 minutes, study the case and use the ethical decision-making framework to identify, decide, and recommend.

Grading Rubric for Engineering Ethics Real-World Cases

Performance Level→ Learning Objective↓	Exceeding Expectations	Meeting Expectations	Nearing Expectations	Not Meeting Expectations
1. Identify ethical issues in real-world scenarios	The student will identify the main ethical issues in all 8 cases and cite the relevant sections of the code of ethics, rules of conduct, and **DFEI** principles.	The student will identify the main ethical issues in at least 6 cases and cite most of the relevant sections in the code of ethics, rules of conduct, and **DFEI** principles.	The student will identify the main ethical issues in at least 4 cases and cite some of the relevant sections in the code of ethics, rules of conduct, and **DFEI** principles.	The student will only identify ethical issues in 2 cases and will not cite the relevant sections in the code of ethics, rules of conduct, and **DFEI** principles.
2. Practice ethical decision-making using ethical principles	The student will generate multiple ethical solutions in all 8 cases, justify and discuss these solutions, and use ethical decision-making [end, rule, or care] in dilemmas.	The student will generate multiple ethical solutions in at least 6 cases, justify and discuss these solutions, and use ethical decision-making [end, rule, or care] in dilemmas.	The student will generate some ethical solutions in at least 4 cases, justify and discuss these solutions, and use ethical decision-making [end, rule, or care] in dilemmas.	The student will generate ethical solutions in only 2 cases, justify and discuss some of these solutions, and use ethical decision-making [end, rule, or care] in dilemmas.
3. Recommend professional actions to address ethical implications	The student will recommend professional action(s); clearly and concisely communicate the optimal solution(s) in all 8 cases.	The student will recommend professional action(s); clearly and concisely communicate the optimal solution(s) in at least 6 cases.	The student will recommend professional action(s); clearly and concisely communicate the optimal solution(s) in at least 4 cases.	The student will recommend some professional action(s); communicate the optimal solution(s) in 2 cases only.

Geothermal Energy SWOT Analysis

	Pros (+ve)	Cons (-ve)
Internal	Environment and sustainable: Reliable and clean once built Relatively low upkeep Surface Footprint: Smaller surface area Recyclable: Easy to recycle turbines Safe once built Very efficient End of life cycle considerations: plants are replaceable and do not become obsolete quickly **Strengths**	Capital Costs: Most locations cannot be cheaply drilled Fresh water: Can require a lot of water to use Takes awhile to build High upfront costs Drilling operations are dangerous Drilling operations can leak buried gasses **Weaknesses**
External	Benefits from innovation in other energy types There are wastes that can be utilized but are not due to limited technology ‘ Area constraints can be overcome with sufficient technology advancement **Opportunities**	People hate any drilling projects Lack of current incentives Extreme up front costs Uneducation of Public leads to misconceptions **Threats**

Responses

- “Ethical engineers will be able to prevent major problems and keep **trust** between themselves, corporate, customers, and employees.
- “A long term benefit from principles such as **Trust** would create a successful foundation for future projects. Another long term benefit would come from following the **laws**. While this obviously would avoid all legal issues that could arise by trying to find short cuts, it would also set precedent for the employees and other companies to practice their trade **fairly**.”
- “In the long-term, these [**DFEI**] principles generate success and a good reputation for being a faithful agent to clients and the public. In the short-term, these help keep people informed and safe, both in the public and the benefactors of these decisions.”
- “According to NSPE, II.1, an engineer must hold public safety paramount. From the **Daniels Fund**, the engineer should create a viable solution for the long term life of the building.”

Lessons Learned

- Ethical decision-making is at the core of all engineering disciplines
- Training on ethics early encourages professional engineering
- The Code of Ethics and Daniels Fund Ethics principles are effective
- Multiple means of assessment and learning activities engage students
- Students could help finalize the grading rubrics and decision-making framework
- Train students on ethics early and often

Thank You

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