Exploring ethics and communication in a first year Engineering Biology course: A case-based debate approach

University of Waterloo Annual Teaching and Learning Conference
Opportunities and New Directions

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Ethical responsibility

Environmental responsibility

Social responsibility

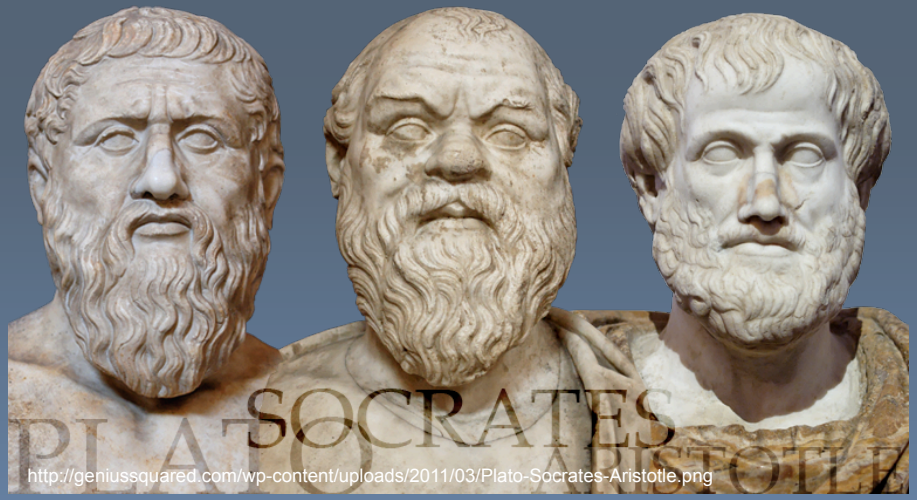
Academic responsibility

Professional responsibility

Teaching ethics

- The age old question:

Can ethical behaviour be taught?



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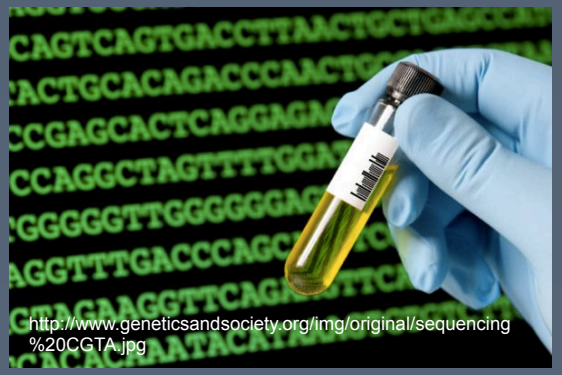
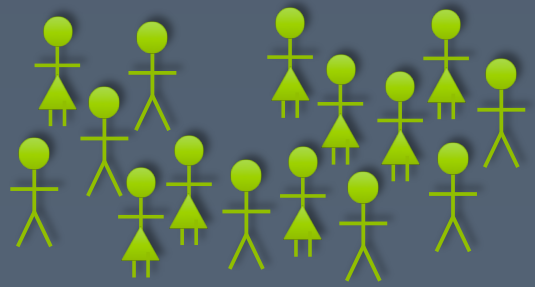
CHE161 Engineering Biology

- Introduction to biochemistry, cell biology, genetics, and bioprocessing
- Engineering biology is rife with ethical debate:
  - Nanobiotechnology
  - Biofuels
  - Genetic susceptibility testing
  - Gene sequence patenting
  - Etc.



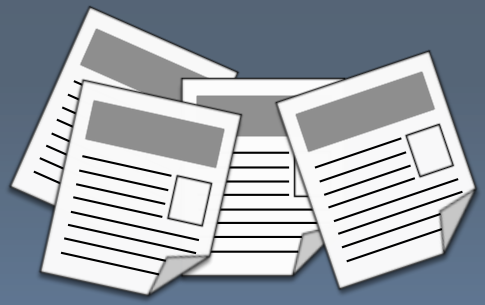
- This presents an opportunity to involve junior engineering students in ethical discussions

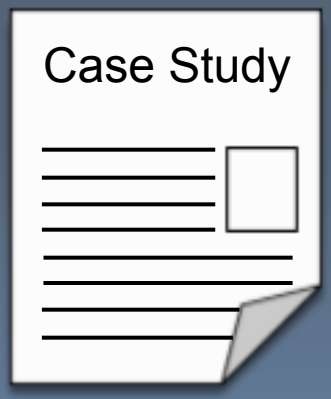
Tutorial format



Expert Panel

Active Audience





Case studies

- Nanobiotechnology (AgNP)
- Biofuels, bio-based materials (LCA)
- Gene patenting
- Genetic susceptibility testing
- Transgenic animals
- Genetically modified crops
- Stem cell-based products

Deliverables

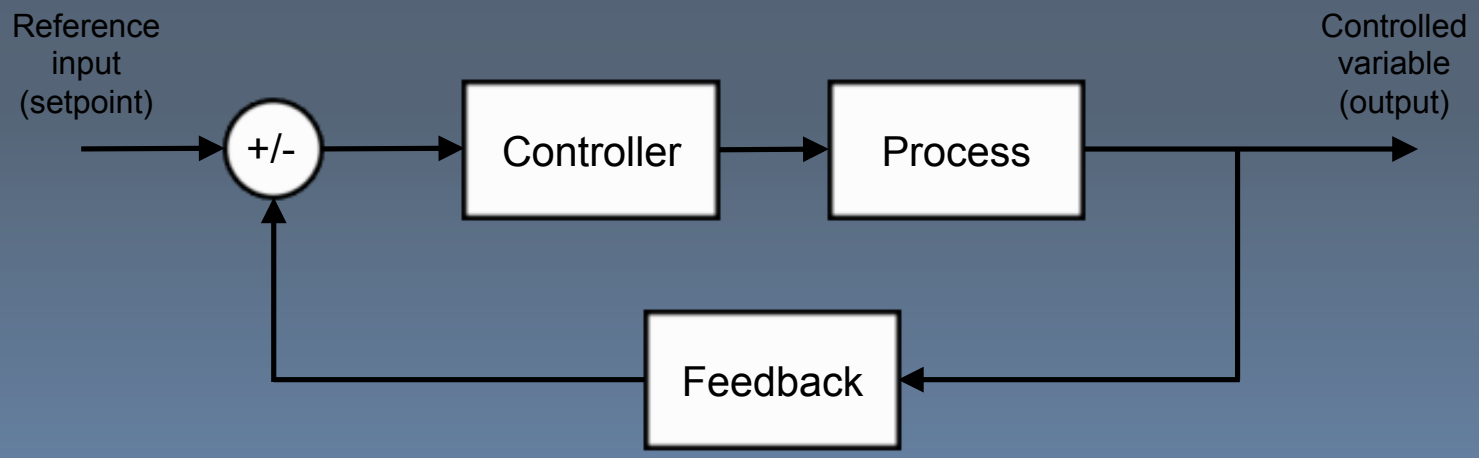
i. Two-page written report
   - Assessed in pairs
   - Requirements:
     (a) brief **discussion of the case**
     (b) presentation of **risks/benefits** relating to case
     (c) statement that clearly outlines the **students' position** in the debate
     (d) arguments **supporting their position**
     (e) **recommendations**

ii. Participation as an expert panelist
   - Assessed individually based on **participation, teamwork, and overall knowledge** of the case

iii. Participation as an audience member
   - Assessed individually based on their **involvement** in the discussion

Student feedback

- Anonymous end-of-term questionnaire
- Five statements rated by the students from “strongly disagree” to “strongly agree”
- Overall qualitative feedback and course recommendations also received



Qualitative feedback – W2014

"Having to articulate our findings in a short time interval helped me to think and communicate systematically."

"Each group illuminated the conversation from a different perspective, thereby enriching my total understanding"

"The variety of topics… had a few common universal questions, which were not easy to answer."

"Use topics that relate more to class"

"Have a short class on ethics before commencing the presentations. This would equip the students to evaluate the technologies and their impacts more clearly."

Qualitative feedback – S2014

"I enjoyed hearing all the different opinions. It helped me formulate an opinion of my own."

"All the topics link between concepts we've learned… before, the topics seemed disconnected."

"Less redundancy."

"Split panel/audience into smaller sections."

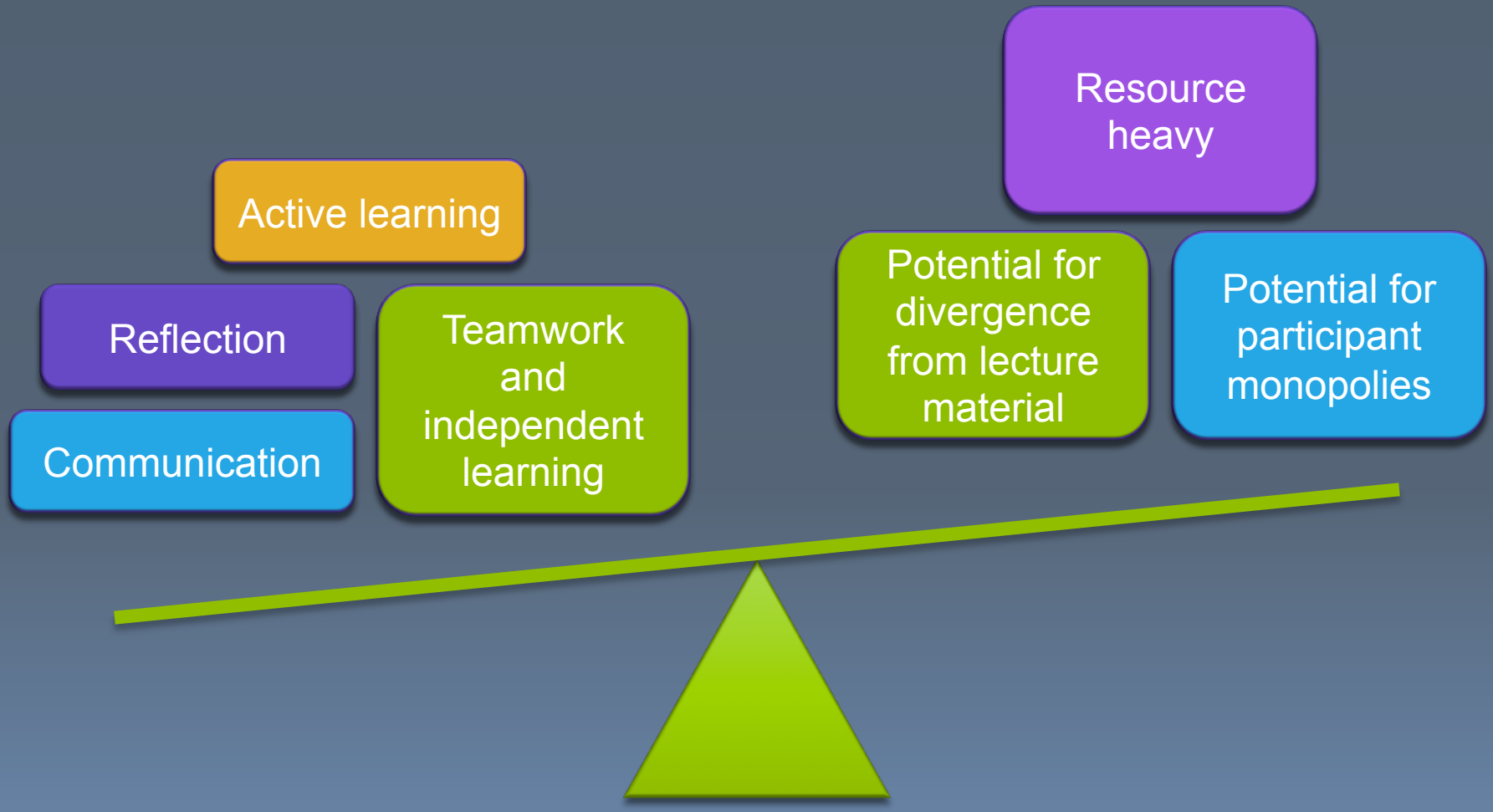
"Make it less formal… no marks for asking questions… too much pressure and forces people to ask redundant questions"

CEAB graduate attributes

1. A knowledge base for engineering
2. Problem analysis
3. Investigation
4. Design
5. Use of engineering tools
6. Individual and team work
7. Communication skills
8. Professionalism
9. Impact of engineering on society and environment
10. Ethics and equity
11. Economics and project management
12. Life-long learning

Engineers Canada. (2013). *Canadian Engineering Accreditation Board Accreditation Criteria and Procedures.* Retrieved Sept 15, 2014, from http://www.engineerscanada.ca/sites/default/files/sites/default/files/accreditation_criteria_procedures_2013.pdf

Advantages and disadvantages



Keys to success

Clearly state and explain expectations

Actively avoid participant monopolies

Success

Set ground rules and abide by them

Facilitate - keep the discussion on track

Bottom line

- *Engage* engineering students in *ethical discussion*
- Provides students with the opportunity to develop their *own moral compass*
- *Communication* and *teamwork*
- *CEAB graduate attributes*

Acknowledgments

- Carolyn Lee-Parsons
  - Professor, Chemical Engineering, Northeastern University
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- Katharina Hassel
  - PhD Candidate, Chemical Engineering, University of Waterloo
- The students of CHE 161

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Questions?

Supplementary information

Presentation rubric

Group number:	
Names of members:	
Discussion topic:	

Category	**Minimal**	**Basic**	**Good**	**Excellent**	**Comments**
Summary • How well has the biotechnology been summarized? • Major facts covered?					
Relation to course concepts • Has the topic been connected to topics discussed in class? • Are quality connections made (i.e. specific)?					
Impact of technology • Benefits/drawbacks clearly articulated? • Examples of applications? • Limiting factors? • Proper citations?					
Conclusion • Arguments for or against the given technology? • Conditions or limitations? • Responsibilities of practitioners? • Recommendations?					

Report rubric

Summary of bio-related technology	• How well has the bio related technology been summarized? • Are the major facts succinctly described?		/5
Relationship to Course Concepts	• Has the bio related technology been related to the concepts discussed in class? • Does the summary demonstrate insights into how the bio related technology is connected to the course's concepts?		/5
Bio related Technology and its Impacts	• Are benefits, risks/drawbacks and other issues clearly articulated? • Are examples of the application of the bio related technology presented? If no applications are presented, what are the limiting factors? • Are scientific references used and properly cited (number, quality and appropriateness)?	.	/5
Responsibilities of Practitioners and Recommendations	- Are the responsibilities of practitioners clearly defined? - Are recommendations for the application of the bio related technology clearly identified?		/5
		Total Mark	/20