LAIS398 Professional Formation of Scientists and Engineers
A hands-on experience in research, ethics, and communication

BACKGROUND

Course Description:
This 3-credit junior-level class covers the basic skills needed for research, research ethics, and communication. The class covers the practice of the research process, research ethics, as well as oral and written communication, and general career-oriented topics. Students acquire hands-on experience by choosing a research project, perform a literature search, develop critical thinking skills, making a work plan, writing a proposal, articulating the broader impact of the research, and communicating the proposal. The proposal can be the start of a senior design project. The class counts as a proposal. The proposal can be the start of a senior design project. The class counts as one of the LAIS electives for undergraduates.

Purpose of the Course Redesign:
1. Increase student motivation for the class by creating a lively, interactive, and enthusiastic class atmosphere, with many opportunities for students to practice and receive feedback.
2. Allow students without prior exposure to research experience the research process.
3. Innovation in teaching communication … difference between ineffective and effective communication … based on case studies and collaborative work.
4. Experiment with a novel approach to teaching ethics that is based on personal values and meaning (in addition to an applied philosophical approach).
5. Improved alignment of curriculum, assessment, and pedagogy compared to previous design of the class.

REDEIGNED COURSE

Outcomes of the Innovation Process:
1. Adapt teaching style so that it engages undergraduate students.
2. Increase motivation of students to learn compared to the previous version of the class.
3. Change ethics pedagogy towards a values-based approach which requires personal reflection and interaction.
4. Provide students with hands-on experience in professional skills, including communication skills.
5. Establish the connection between research, communication, and ethics.

INTENDED OUTCOMES

Outcomes of the Innovation Process:
1. Adapt teaching style so that it engages undergraduate students.
2. Increase motivation of students to learn compared to the previous version of the class.
3. Change ethics pedagogy towards a values-based approach which requires personal reflection and interaction.
4. Provide students with hands-on experience in professional skills, including communication skills.
5. Establish the connection between research, communication, and ethics.

ASSESSMENT

- Pre/post test of research skills, ethical awareness, and communication skills.
- Solicit feedback from students throughout the semester.
- End of semester evaluation.
- Peer feedback to teachers from other faculty at Mines.
- Evaluation of class work, homework, and projects in relation to outcomes
  - A comparison with a control group is not realistic because the class has been taught only once before.

ACKNOWLEDGEMENTS

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Example of an Active Learning Exercise

Learning outcome: Articulate major moral implications of genetic engineering.

Description of task (25 minutes):
1. In preparation for the discussion watch the Ted lecture “To Upgrade is Human” by Gregory Stock before class. While watching the video think of the ethical aspects of his work and make notes of any ethical aspects that come to mind.
2. Get together in groups of four. Designate a scribe that add notes of the group conversation to a concept board (electronic sticky notes).
3. Remind students of the rights and obligations of class conversations.
4. Every group member articulates a consequence of the technologies advocated by Stock with which you have ethical concerns. The task is to share concerns, not to discuss or debate them (10 minutes).
5. Speculate for each of the concerns identified what one (unintended) consequence might be. (10 minutes)
6. Notes submitted to the concept board form the basis for a follow-up class conversation. Make sure that the names of all group members are on the concept board. The notes are graded by peer graders who are asked to make suggestion for a follow-up class conversation.

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