

Incorporating Sustainability Throughout Kettering University's Undergraduate Curriculum

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Introduction

- Established in 1919, Kettering University is rooted in the automotive industry (General Motors), and primarily offers engineering degrees
- Students engage in an integrated co-op program throughout their university years, completing a of minimum 5 co-op rotations.
- Recently, the university has made efforts to integrate sustainability into program offerings. A Minor in Sustainability was added in 2023.
- However, sustainability offerings across the curriculum are currently limited and disjointed; students not enrolled in the minor are less likely to be exposed to sustainability-related courses.

Project Overview

Goal: Begin weaving sustainability concepts throughout the university curriculum.

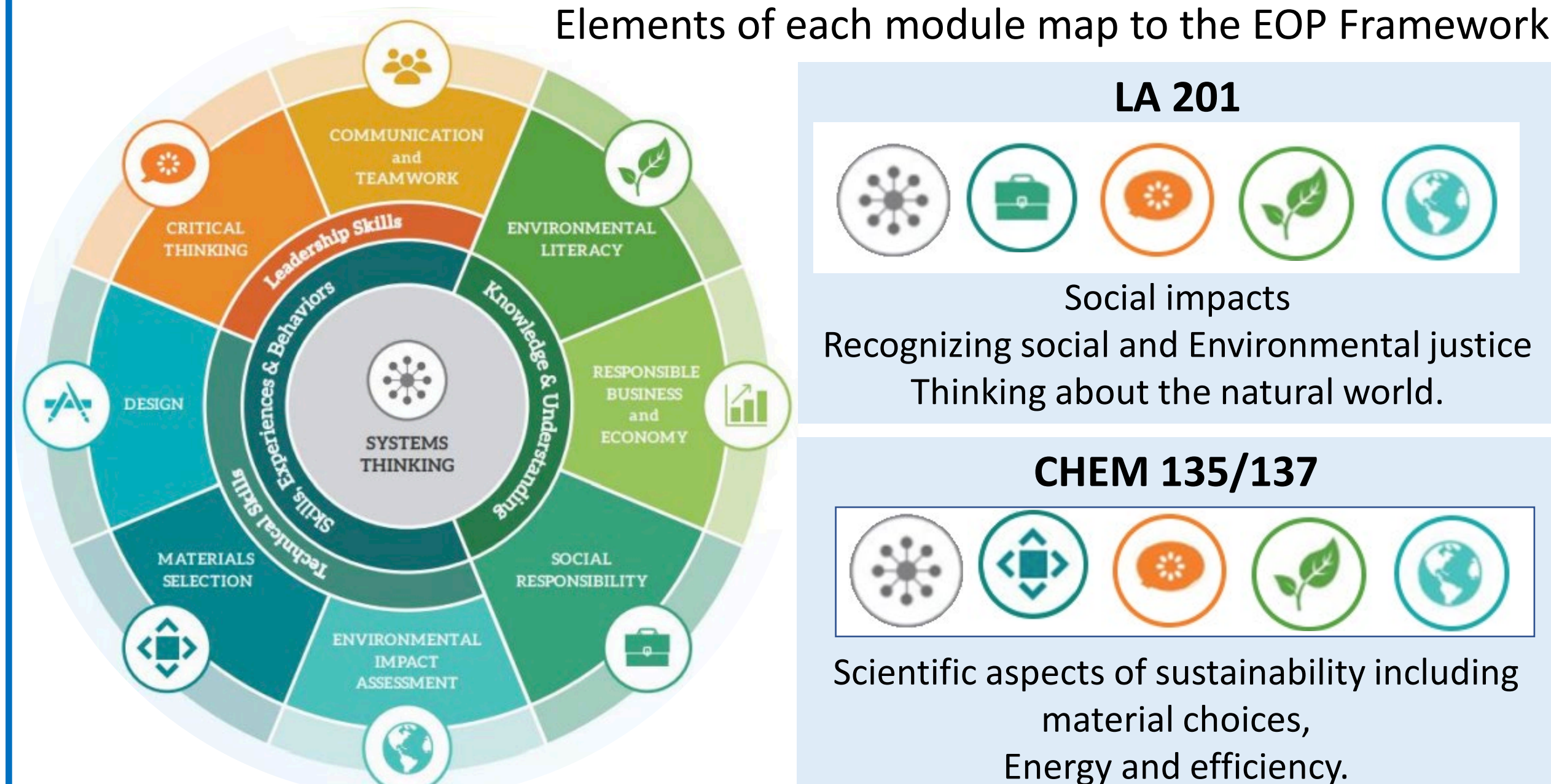
Method: Introduce sustainability concepts early to students in the following "gateway" courses, freshmen chemistry (CHEM 135/137) and a liberal arts sophomore seminar (LA 201), by:

- Developing short video case studies and accompanying lesson plans.
- Mapping lesson plans and course content to introductory EOP outcomes.
- Extending case study topics in upper-level engineering course material (Winter 2024) and mapping to advanced EOP outcomes.
- Circulating videos/lesson plans for faculty to incorporate in other courses.

Outcome: Sustainability concepts and EOP learning outcomes are scaffolded across the curriculum; students are exposed to core sustainability concepts in years 1 and 2.

EOP Framework Mapping

Elements of each module map to the EOP Framework.



Project mapping to EOP: Systems Thinking, Environmental Literacy, Critical Thinking, Communication and teamwork, Social Responsibility, Materials Selection, Design, Environmental Impact Assessment

Case Study Videos and Lesson Plans

Lithium Learning Videos

Summer 2023:



Feature lithium's importance, uses, and production



~4 minutes long

Hosted YouTube



Access QR code

Environmental Justice Lesson Plans

Introduce and explore EJ in the context of lithium demand; can be taught in conjunction with videos.

Case study featured:

Paiute-Shoshone resistance to the Thacker Pass Lithium mine, Nevada.

Modes of learning:

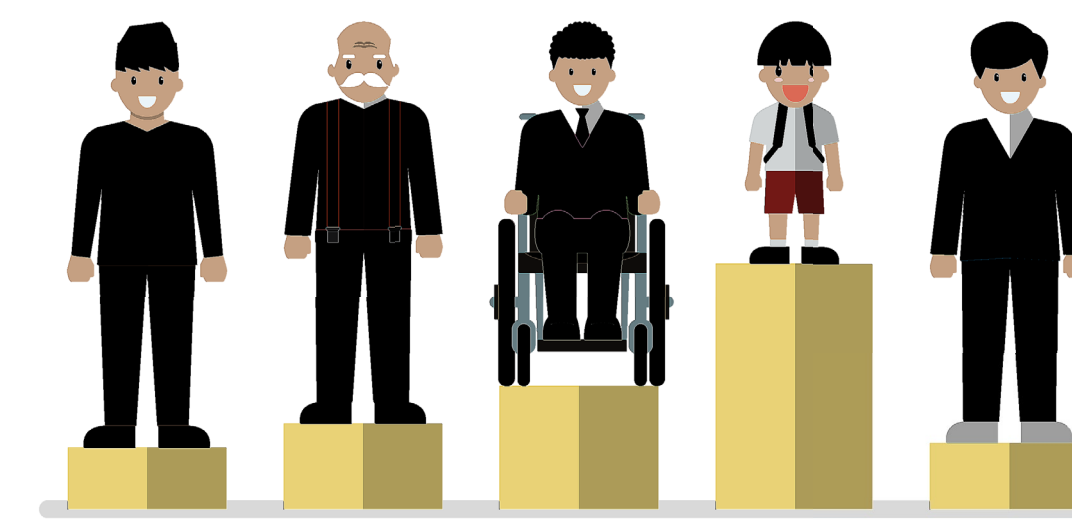
Personal and non-fiction stories, history, discussion.

EOP focus:

Social responsibility.

DEJ principles:

Dignity and cultural features of a historically excluded group.



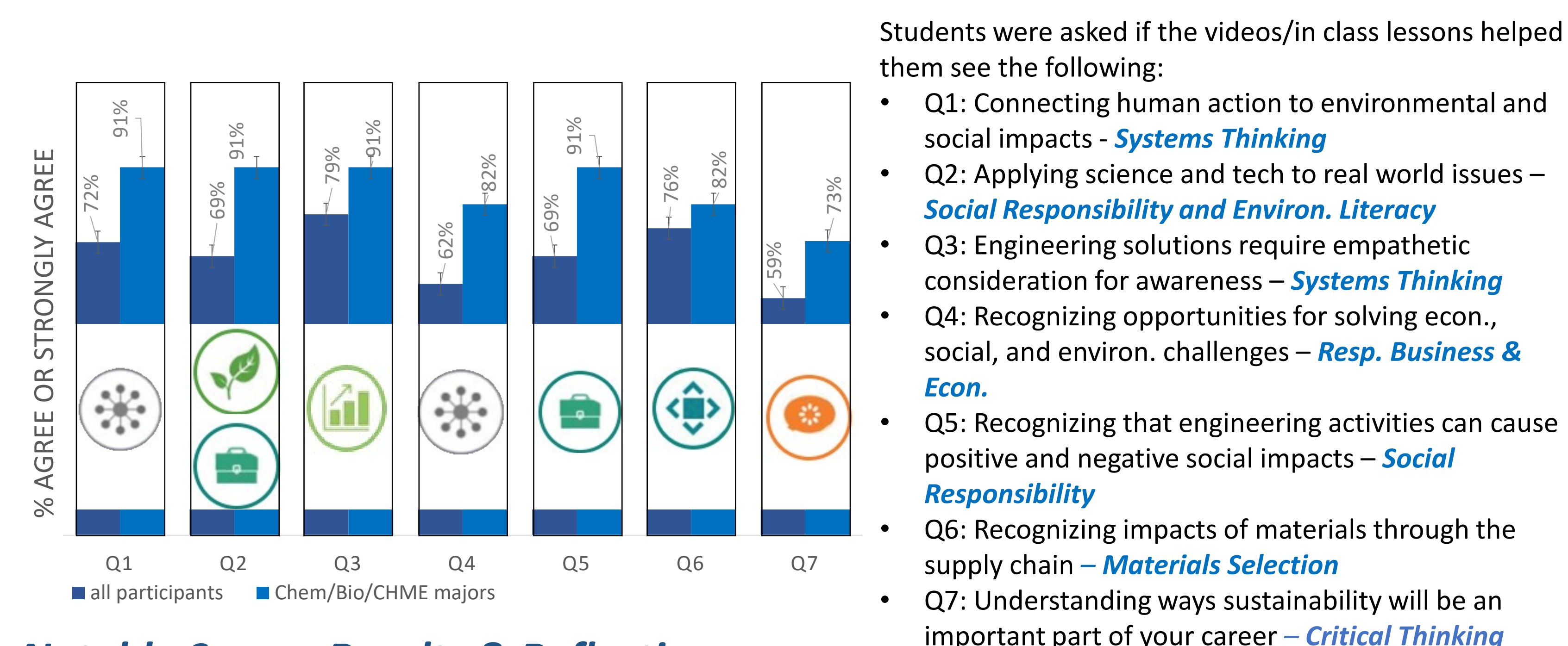
Surveying Learning

Fall 2023:

Videos were piloted in CHEM 135/137, LA 201, freshmen orientation (CILE 101) and CHEM 437
CHEM 135/137 survey questions were created to align chemistry content with the videos

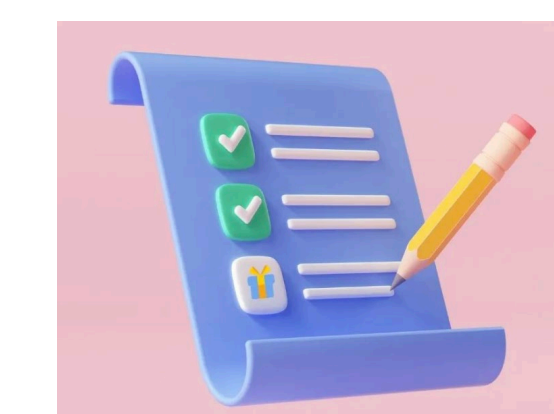
LA 201 and CILE 101: Survey questions were created to assess achievement of social and environmental EOP outcomes.

Key Findings



Notable Survey Results & Reflections

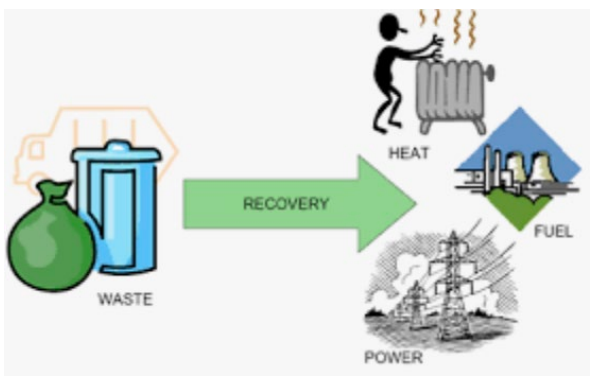
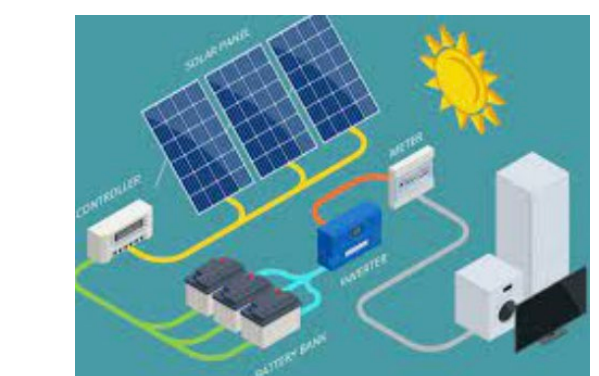
- 28% of participants answered "Yes" when asked if they would be interested in pursuing the sustainability minor. **Next steps:** boost student interest in sustainability
- Higher % of students "agreeing" to questions had some chemistry background (e.g., chemistry/chemical engineering/biology majors). **Next steps:** integrate sustainability as a core topic across university curriculum
- Note: not all participants completed the survey. **Next steps:** boost survey response
 - CILE 101 - 4 surveys completed (50+ students are enrolled in CILE 101)
 - CHEM courses - 11 surveys completed (40+ students in CHEM 135)
 - LA 201 - 15 surveys completed (out of 17 students)



Plans for Future Case Studies

Finalizing Case Study 2: Plastics

- Lesson plan created; focus on microplastics, social justice, and tire dust.
- Video content has begun; focus on defining polymers, plastic use, recycling, and sustainability issues like microplastics



Other Case Study Ideas:

- Offshore Wind Energy
- GMO Seeds
- Waste to Energy
- Solar Energy

Future Work and Challenges

Piloting Upper-Level Engineering Course

- CHME 360: Sustainable Engineering Design will be offered in Winter and Spring 2024.
- Course content will build off similar themes from case studies.
- Students will create videos similar to this project's case study videos as part of their final projects.
- Concepts will map to additional EOP outcomes such as Design, Materials, Communication, and Critical Thinking.

Anticipated Challenges - future case studies



- Making lesson plans flexible enough to be "stackable" on material taught across disciplines and departments.
- Ensuring lesson plan/video material are not repeated across too many classes; that faculty are scaffolding and not repeating the same learning objectives.

Acknowledgments and Project Links

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Links to Lithium Learning Videos:

- [Part 1: Introducing Lithium](#)
- [Part 2: Lithium Production & Demand](#)
- [Part 3: Lithium Extraction](#)

Link to EJ Lesson Plans:

- [Introducing and exploring EJ within the context of lithium use and production](#)