Energy Conversion & Sustainability Education Insights

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Given that energy is critical to our society [1], it is important that universities develop and/or strengthen programs in the energy area [2], especially as they relate to sustainability. To address this need, a course was developed as a foundational course within energy conversion and sustainability that was open to both engineering and non-engineering students as discussed in [3]. At the end of the course, students were surveyed regarding their educational experiences. Due to the limited sample size, more in-depth analysis tools were used. This paper is a follow-up to the work in [3] with goals of slightly expanding the sample size, determining any trends within the data, and discussing insights from the open-ended questions.

In the survey from both class offerings, students were surveyed about the impacts of the course and the relative usefulness of different educational tools and experiences. Results from perceptions about the impacts that the course had on how students viewed engineering, energy, sustainability, and the global-nature of these topics included:

- Students again unanimously perceived the strongest impact to be on their understanding of the global nature of energy issues.
- The lowest average ranking was a 2.9 (3 = Agree to Large Extent), which was in regards to [continuing to] pursue an engineering degree.
- Unlike previously, problem solving was not ranked as high relative to the other impacts.

Results from opinions about the relative usefulness of different tools and experiences included:

- Real-world technical problems was again ranked as the most useful, followed closely by generic technical problems.
- The lowest average ranking was 2.4 (2 = Moderately Helpful) for Pre-Lecture Questions (PLQs); these were also close to the bottom previously.
- More value was seen in the quizzes and exams by this group relative to other aspects.

Common themes from open-ended survey questions included an overall satisfactory experience with the course, an appreciation for the hands-on learning aspects, and a mixed response about the course projects. Furthermore, field trips were *not* rated comparatively high in both years.

Other analyses included an examination of (previously drawn/explained) Earth-Sun interaction concept maps and a pre-post course objective evaluation. For the former, the average number of connections increased by 35%. However, a change in the directions to "make as many connections as possible" may have had a greater impact than the benefit of drawing concept maps explicitly. For the pre-post evaluations, a new classification of three levels of question difficulty showed larger learning gains in harder levels. The analysis again showed greater

technical objective improvement comparatively, which was furthermore irrespective of difficulty.

In summary, the course offered a broad understanding to a diverse group of students. Even with the limited sample size, the usefulness of real-world technical problems and impact on students' understanding of global energy issues seem to be compelling relative to the other areas. However, the authors will collect more samples and will probe further into identifying and addressing common issues with understanding energy conversion and sustainability concepts.

Bibliography

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