<u>Teaching and Learning Goal:</u> What skill or ability do you want students to acquire? What behavior do you want to change? What knowledge do you want to test? What assumptions (either students' or the instructor's) do you want to test? Focus on only one such goal

TAR Question: How do case studies elicit student knowledge of chemical core ideas and connect them to practice (the design and evaluation of solutions)?

<u>Teaching Question:</u> Adapt the teaching and learning goal to a specific course. Make this question narrow and focused so that it can be measured.

TAR Objectives:

1. Describe the ability of students to explain mechanisms through core chemical ideas
2. Quantify the frequency students articulate repercussions or conflict between U.N Sustainable Development Goals (SDGs) of the solution.
3. Evaluate the relationship between mechanistic explanations and students' incorporation of knock-on effects.

<u>Assessment Technique:</u> What instrument are you going to use to collect information? Is it simple enough that you know how to analyze the results? Will the information it provides answer the teaching question?

1. Students mechanistic reasoning responses on worksheets were coded using a pre-existing and validated codebook analyzing their use of core chemical ideas
2. The number of SDGs students brought up on a question about the effects of proposed solutions on SDGs was counted
3. The results of 1 & 2 were tied together and the average number of SDGs brought up was calculated for each mechanistic reasoning code

See *Classroom Assessment Techniques* p. 59 for a helpful "Checklist for Avoiding Problems with Classroom Assessment Projects"

Classroom Practice: **What assignment or activity are you going to use in the class to try to test the question? When are you going to do it? Who will conduct it? Will it be graded? Will it be anonymous or will students sign their names? How long will it take? How will students know what to do with it? Who will explain it? How will the relationship between this assignment and activity and the course be explained?**

Students in CEM255 completed a case study in during their recitation sections. The class TAs are present to answer questions and provide student support. Case studies are graded for completion. Students sign their names to receive credit, but the online platform automatically anonymizes the responses. Students regularly complete case studies during recitation so it was not a disturbance from the normal class flow.

Summary of Results: **What does the information you collected through the assessment instrument tell you about your teaching question?**

My results did not show any correlation between mechanistic reasoning and student's discussion of knock-on effects (SDGs). This is likely due to problems in the assessment techniques. The codebook for 1 was designed for 1-2 step mechanism and the reaction students explained was ~10 steps. It was too much detail for students reasonably provide. The evidence for this is that the distribution of code values are significantly different from previous uses of the code book on similar student populations. As or counting the number of SDGs students brought up that didn't take into account if they were relevant SDGs. Some students just listed SDGs while other students explained their choices.

Conclusion: **What have you learned? What surprised you? What would you do differently? What implications does this have for your future classroom practice?**

I gained first-hand experience that education research is an ongoing process and that the first time you implement an activity changes are almost a certainty.

I would alter the questions analyzed. For the mechanistic reasoning question, I would ask students to only explain 1 key step from the mechanism. And for the SDG question I want to develop a code book that takes into account students reasoning for discussing the SDGs they chose.

I plan on continuing my exploration of case studies as an activity to explore students ability to translate basic knowledge to applied problems.

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