Evaluation of the impact of a multistep synthesis project

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Introduction

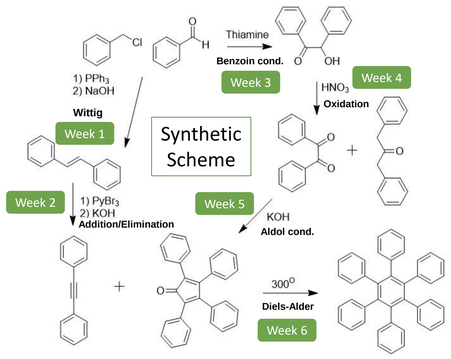
Multistep Synthesis:
- A **newer alternative** to traditional cookbook labs
- Potential advantages:
  - Resembles real-world synthesis
  - Increases student interest and engagement
  - Increases student sense of accomplishment

A multistep synthesis project was implemented for 2 years in an Organic Chemistry II Lab course.

Guiding Question:
Is the project effective?
- Specifically, is there alignment between course goals and what students find valuable?

Course Details

- Organic Chemistry II Lab project
- Multistep synthesis
- Introduce students to green chemistry
- Work in groups
- Students write papers in Journal of Organic Chemistry format



Methods

Data:
- 113 student completed surveys
- 13-16 open-ended questions
- Spring 2018, Spring 2019

Coding/ Analysis:
- Open coding
- Student responses assigned to multiple themes

Discussion

Course goals were met:
- Students reported they gained **lab skills** and **experience** pertinent to organic chemistry
- Students made the **connection** between **lab and lecture**
- Students learned to write a **scientific paper**
- Students learned about **green chemistry** and **green metrics**

There was **alignment** between the instructor intended purpose (course goals), the student perceived purpose, and the student perceived value.

Future Directions

Evaluate student outcomes using:
1. CURE survey
   - Pre/ post course survey using Likert scales
   - Assesses student perceived gains and ideas about science
2. ELIPSS Process Skills Rubrics
   - Assesses critical thinking and problem solving abilities

References:
- Cole, R., Lantz, J., and Ruder, S. (2017). ELIPSS: Enhancing Learning by Improving Process Skills in STEM. Retrieved from http://elipss.com/. Accessed July 2019.
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- Ji, C. and Peters, D. G. (2006). A Multistep Synthesis for an Advanced Undergraduate Organic Chemistry Laboratory. *Journal of Chemical Education 83*(2), 290-291.
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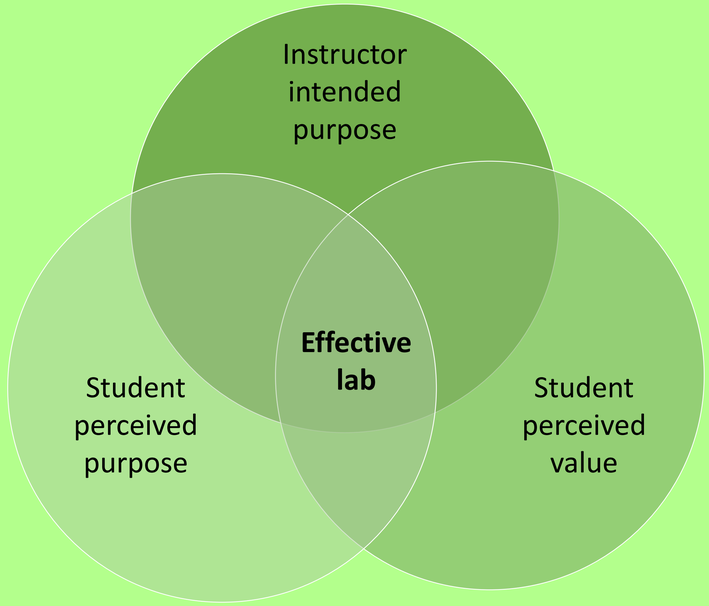
A **multistep synthesis** project was **effectively** implemented in an Organic Chemistry II Laboratory course.

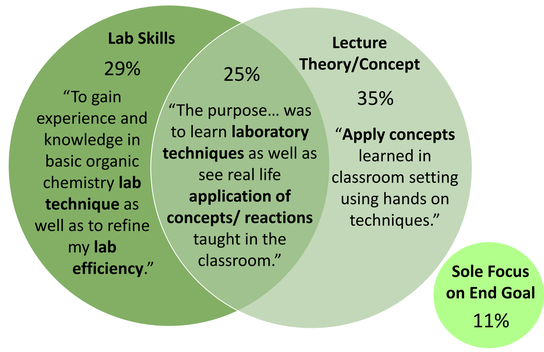


Scan for all survey questions and the themes developed from student responses

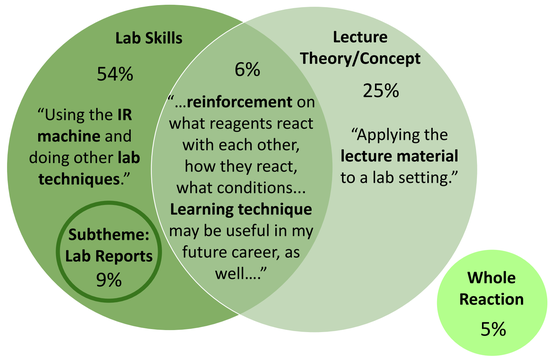
Results

Course Goal #1:
Students perform synthesis of organic molecules.

Survey Question: What did you see as the **purpose** of your lab?

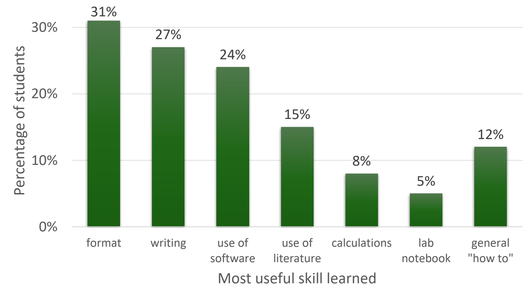


Survey Question: Please identify those aspects of lab you found most **useful** or **valuable** for your learning.



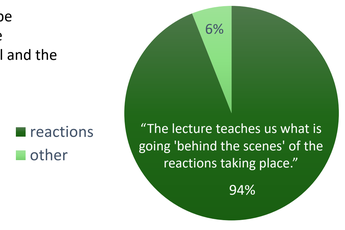
Course Goal #2:
Students communicate experimental results in written reports.

Survey Question: What was the most **useful skill** you have learned when you were writing the final report?



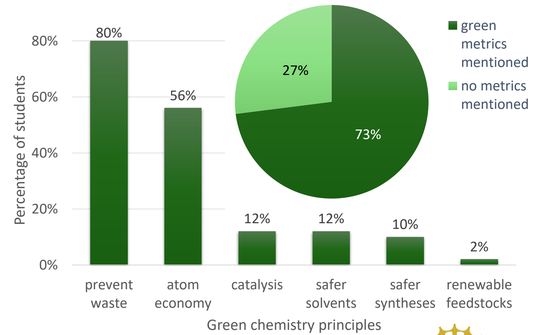
Course Goal #3:
The concepts students are taught in lecture are reinforced in lab.

Survey Question: Describe **connections** that you see between lecture material and the experiments that were conducted?



Course Goal #4:
Students are introduced to green chemistry concepts.

Survey Question: List **green chemistry** concepts you learned this semester.



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