

# Preparing Our Future Scientists: Supporting Students' Argumentation Skills Through Organic Chemistry

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Literature Seminar

When: September 16, 2024

Time: 3:00 p.m.

Location: CB LL-16

## Abstract:

Argumentation is an essential skill for any practicing scientist. It is outlined by the Next Generation Science Standards (NGSS) as a science and engineering practice that should be integrated along with science concepts to prepare students to apply their acquired knowledge to a broad range of scientific phenomenon [1]. However, literature shows that students struggle with the practice of argumentation, and little research has been done investigating how to support this skill in undergraduate Organic Chemistry. As Organic Chemistry is often considered a “weed out” course for students in the sciences, support within this course is crucial to the success of our future scientists. Lieber and Graulich conducted interviews to determine students' argumentation patterns when participants were prompted to argue for multiple reaction pathways [2]. Students used differing amounts of evidence and reasoning in their arguments, although the chemistry concepts included were similar. Additionally, more students recognized the correct products as plausible after being introduced to alternate reaction pathways. Deng and Flynn investigated students' argumentation by characterizing modes of reasoning, levels of granularity, and levels of comparison between two chemistry contexts: acid-base equilibria and a reaction mechanism [3]. The structure of student arguments varied in terms of correctness and was dependent on the conceptual context. Finally, Petritis et al. explored how framing laboratory experiments affected the nature of student arguments regarding their laboratory results [4]. In the traditional “cookbook” experiment, students were provided the structure of their starting materials before the experiment, while students in the “inquiry-based” frame did not receive this information. The researchers found that not only did students in the inquiry group differ in the chemistry concepts they utilized in comparison with their traditional peers, but the former also incorporated more data along to support their arguments. These observed variations in how students are engaging in argumentation in Organic Chemistry highlights the ways in which this critical scientific skill can be supported and further refined to ultimately promote a more sophisticated conceptual understanding.

## Resources:

1. National Research Council. A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas; National Academies Press, 2012. DOI: 10.17226/13165
2. Lieber, L., & Graulich, N. (2022). Investigating students' argumentation when judging the plausibility of alternative reaction pathways in organic chemistry. *Chemistry Education Research and Practice*, 23(1), 38-54.
3. Deng, J. M., & Flynn, A. B. (2021). Reasoning, granularity, and comparisons in students' arguments on two organic chemistry items. *Chemistry Education Research and Practice*, 22(3), 749-771.
4. Petritis, S. J., Kelley, C., & Talanquer, V. (2021). Exploring the impact of the framing of a laboratory experiment on the nature of student argumentation. *Chemistry Education Research and Practice*, 22(1), 105-121.