



## Shaping meaningful conceptualisations in undergraduate Physical Chemistry using a flipped learning approach

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### Abstract

Physical chemistry is frequently perceived by undergraduate students as conceptually challenging due to its abstract nature and strong reliance on mathematical reasoning. Successful learning requires students to integrate multiple microconcepts and make meaningful connections between macroscopic, microscopic, and symbolic representations (Reid, 2021). For first-year students in particular, these demands often result in cognitive overload, low engagement, and limited participation in traditional lecture settings.

Flipped learning offers a potential solution to these challenges by reallocating foundational content delivery outside scheduled contact hours and using in-class time for active learning. While flipped learning has been implemented previously within chemistry education, its application in physical chemistry remains underexplored.

The aim of this project is to measure the impact of using bite-sized pre-lecture videos on the student engagement and understanding physical chemistry topics during lecture. These videos were co-created and prepared by student, positioning them as active contributors to curriculum design through a student-as-partners approach (Haripottawekul et al., 2025). These videos focused on core physical chemistry concepts and were provided prior to taught sessions. Two formats-interactive and non-interactive were developed to compare engagement and perceived understanding. The impact of this approach was evaluated using pre- and post-engagement surveys measuring students' perceived understanding of the video content. Findings indicate a positive influence of student-prepared flipped resources on engagement and learning with good student-feedback. The study demonstrates that student-partnered content creation within a flipped physical chemistry curriculum can meaningfully enhance learning experiences and outcomes.

### Keywords

flipped learning, physical chemistry, pre-lecture video, student-as-partner

### Citation:

Croft, A. & Debgupta J. (2026). Shaping meaningful conceptualisations in undergraduate Physical Chemistry using a flipped learning approach. *Journal of Scholarship of Teaching and Learning Enquiry*, 1(1). <https://doi.org/10.7190/jostle.v1i1.627>

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