Students' Perceptions of Teaching and Learning in Intro Organic Chemistry

Ashley Welsh, PhD Candidate
Department of Curriculum & Pedagogy, UBC

Jackie Stewart, Instructor
Department of Chemistry, UBC

Purpose

- To explore how students' metacognition and self-efficacy change over the course of the semester
- To gain knowledge about how students study and the factors they perceive as limiting/enhancing their learning
- To understand the events, activities, and/or interactions that students perceive as triggering how they think about and approach their learning
- To find out students' perceptions of the course curriculum and pedagogy

Background

- Organic chemistry has a reputation as a challenging course (Grove & Bretz 2012; Lynch & Trujillo, 2010)
- Undergraduates often lack the metacognitive skills and self-efficacy to be successful in organic chemistry (Zhao et al., 2014)
- **Metacognition** is the ability for students to control, evaluate, plan, and monitor their learning (Flavell, 1979)
- **Self-efficacy** is a student's confidence in their ability to tackle a particular task or course (Bandura, 1993; Schraw et al., 2006)

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- This course had roughly 1,100 registered students in five sections
  - The participants in this study were enrolled in two sections during term 1 of 2013/2014
- The majority of students were in their 2nd year of a biological sciences degree
- This course has recently adopted aspects of a flipped classroom approach
  - Outside of lecture: Pre-class videos, quizzes, and problem sets (graded online and ungraded paper-based)
  - Within lecture: Group worksheets, clicker questions, practice

Data Collection Tools

- Pre-post SEMLI-S (Self-Efficacy & Metacognition Learning Inventory – Science) survey instrument
- Midterm reflections and survey responses
- Classroom observations
- End-of-term individual student interviews (n=26)
- Student grades

Preliminary Findings: SEMLI-S

- Initial analysis of the SEMLI-S reveals a significant drop in students' perceptions of their:
  - Ability to connect organic chemistry to other courses and their life *(t=4.69, p<.001)*
  - Strategies for monitoring, planning, and evaluating their learning *(t=3.69, p=.001)*
  - Self-efficacy *(t=2.131, p=.035)*
- There was no significant difference in students' perceptions of their:
  - Awareness of their weaknesses (t=0.174, p=.862)
  - Control of their concentration (t=0.141, p=.888)

Preliminary Findings: Interviews/Survey Responses

*Interviews are currently being transcribed and analyzed

Preliminary analysis reveals:

- Successful students exhibit metacognitive strategies and high self-efficacy
- Mid/low-performing students rarely implement advice from the instructor
- Students' preconceived notions of learning limit their success
- Students attribute time pressures and a lack of effective learning strategies as limiting their learning
- Students provide useful feedback on the flipped classroom approach
- The first midterm is the primary crossroad at which students critically reflect upon their learning (and is a crossroad for change in some cases)

"While I do study hard, I don't think I study smart"

Preliminary Findings: Observations and Midterm Survey Responses

- The instructor presents a Learning Sequence and study advice/ workshops to guide student learning
  - Few students remember the sequence/advice despite it being discussed consistently throughout the course
  - Students value this information but do not seem to engage with it
- Students are initially hesitant about the flipped classroom approach
  - Some students comment that they learn best via lecture
  - Students like pre-class videos to be < 25 minutes
- Students appreciate formative feedback

Continuing Analysis

- Comparison of SEMLI-S data with students' exam and course grades
- Transcription of interviews
- Analysis of classroom observations and students' written reflections
- Triangulation of the data
- Providing implications for instructors and students

References

- Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. Educational Psychologist, 28(2), 117-148.
- Flavell, J. H. (1979). Metacognition and cognition monitoring: A new area of cognitive-developmental inquiry. American Psychologist, 34, 906-911.
- Grove, N. P., & Bretz, S. L. (2012). A continuum of learning: from rote memorization to meaningful learning in organic chemistry. Chemistry Education Research and Practice, 13, 201-208.
- Lynch, D. J., & Trujillo, H. (2011). Motivational beliefs and learning strategies in organic chemistry. International Journal of Science and Mathematics Education, 9(1351- 1365).
- Schraw, G., Crippen, K., & Hartley, K. (2006). Promoting Self-Regulation in Science Education: Metacognition as Part of a Broader Perspective on Learning. Research in Science Education, 36(1), 111-139.
- Zhao, N., Wardeska, J.G., McGuire, S.Y., & Cook, E. (2014). Metacognition: An effective tool to promote success in college science learning. *Journal of College Science Teaching, 43*(4), 48-54.