OrganicERs Newsletter Vol. 4 No. 1

Organic Education Resources

A *cCWCS* Community of Scholars

Welcome to Two New Members to the OrganicERs Leadership Board

Alexey Leontyev joins the board from Adams State University in Alamosa, Colorado. Alexey obtained his Ph.D. in Chemistry Education from Richard Hyslop at the University of Northern Colorado. His interests lie in student misconceptions, assessment of the effectiveness of instructional intervention using meta-analysis, and development and evaluation of assessment tools. Alexey has developed a stereochemistry concept inventory.

Leyte Winfield is the Chair of Chemistry and Biochemistry and Interim Associate Provost for Research at Spelman College. Her chemistry education interests are focused on learning communities, peer mentorship and tutoring, and blended classroom activities. She is also interested in the synthesis and design of di-substituted benzimidazoles for their therapeutic potential against cancers disproportionately impacting African Americans.

Watch for the Active Learning in Organic Chemistry Miniworkshop

Applications and more information will soon be available for this summer's miniworkshop June 12 – 15 in Atlanta. As shown on the cCWCS website

> "Studies over the past decade have shown the use of active learning pedagogies in the classroom result in positive student learning outcomes in science courses. These improved outcomes include higher test scores

and final grades, improved conceptual understanding of content, lower withdrawal rates and improved attitudes toward science. There are a number of techniques that can be implemented to make the classroom a more active learning environment, including those that can be retrofitted into a traditional lecture or used to completely flip the classroom.

This four-day workshop will give organic chemistry instructors an opportunity to learn more about innovative pedagogical approaches and the technological tools used to teach organic chemistry with a learner-centered approach. Sessions will include hands-on activities in backward design and the development of student learning goals, different ways to flip your classroom including video lectures, Just-in-Time Teaching (JiTT) and the use of Peer Instruction (PI) along with classroom response systems. Workshop participants will also have the opportunity to try the various support technologies used to implement these pedagogies including screen capture, iPads, Doceri, Explain Everything, clickers, and Livescribe Pens.

Participants will be introduced to an online community (**http://organicers.org**) where they can share course materials such as questions used with clickers or flipped classrooms. This online community also serves as a place for sharing educational resources and communicating about topics via discussion forums.
The workshop begins with a reception and evening session, followed by two and a half days of activities ending with lunch on the last day."

Active Learning in Organic Chemistry at the BCCE

A search of "active learning" or "flipped classroom" in the 2016 BCCE program at the University of Northern Colorado certainly results in a number of hits. From the OrganicERs community, Cathy Welder, Jennifer Muzyka, and Robert Rossi led the Active Learning in Organic Chemistry symposium which had 34 talks from 32 speakers over five sessions. Speakers included many past alum from the cCWCS ALOC workshops over the past four years. Along with presentations about the efficacy of the flipped classroom and JiTT, there were innovative combinations of these pedagogies with technology and other techniques. Active learning was enhanced with iPads, iTunes, Chemwiki, Notability, and other websites, hardware, and software. Other presentations introduced conscious assessment, specifications grading, and student produced videos into their active learning classes. In one ambitious endeavor, the flipped classroom pedagogy was synchronously run at multiple sites. Several presentations demonstrated how active learning was applied to organic laboratory classes.

Justin Houseknecht and Vincent Maloney conducted the Active Learning in Organic Chemistry: Techniques to Engage Students in the Classroom workshop twice with a total of about 40 attendees. Over three hours, each member of the workshop participated in proven activities that focused on how they could design and implement active learning in their classrooms.

The interest in active learning was also demonstrated by two other symposia with multiple sessions that were run over the course of the conference: *Interactive forum on practical strategies and active learning approaches to teaching and learning general chemistry and organic chemistry* and *Flipped classroom application in the university chemistry class*. Other talks and posters were spread throughout other sessions. Due to the high number of applicants, some past participants in the ALOC workshops presented active learning experiences at other sessions.

A Semi-Flipped Classroom for Rural Students in General Chemistry

Mary Lenczewski has a recent article in JCE (**DOI:** 10.1021/acs.jchemed.6b00320) documenting how she adapted active learning for her rural students at Ohio University Eastern (OUE). Mary who attended the 2015 cCWCS Active Learning in Organic Chemistry (ALOC) Workshop in Washington knew that active learning would benefit her students but realized that a fully flipped classroom might not be the best method for general chemistry course. The rural students at OUE had unique needs which had to be addressed in designing active learning for the class.

A fully flipped class exhibits the most benefits for students that take ownership of their learning, are motivated to learn, and have good time management skills. For less academically mature students, a fully flipped class may require an adjustment period and is potentially overwhelming. Rural students tend to be more easily alienated from finishing their degrees if they perceive that they can't succeed. They also have more outside time constraints. These general chemistry students were transitioning from high school to college and might not initially be well prepared for the demands of a fully flipped class.

Instead a "Semi-Flipped" model was developed for the 2014-15 and 2015-16 general chemistry classes where the students could gain confidence and focus on learning. Prior to class, students were given assigned reading from the text along with online extra credit activities that assessed their comprehension. In class, the students started with 10 – 15 min. of group problem solving covering topics from the previous meeting. Subsequently, the class alternated between 10 – 15 min. mini-lectures followed by 5 – 10 min. of problem solving on the material. Lenczewski describes the mini-lectures as more of a dialogue about the material. Further practice follows the class with online homework. Scaffolding was integral in some of the problem solving where problems were broken down into subquestions. Although the assessment was informal, the early

results and feedback were positive concerning the efficacy of the “Semi-Flipped” method.

A Parallel Controlled Study of the Effectiveness of Partially Flipping Organic Chemistry

James Shattuck (University of Hartford, 2015 cCWCS ALOC Workshop in Washington) also has recently published his positive experience with the flipped classroom pedagogy (**DOI**: 10.1021/acs.jchemed.6b00393). Using a partial flip in one of two of his 1st semester organic chemistry sections, he observed several positive effects from increased active learning in comparison to the other section where “traditional” lecture was used. There was a 25% increase in A’s and B’s, 54% decrease in the withdrawal rate, and a significant increase in student performance on test questions where extensive active learning was used for topics for the partially flipped section. Student surveys conducted at the midpoint and end of the semester also indicated other benefits from flipping portions of the class. Students in the flipped section exhibited an increased interest in organic chemistry and increased confidence in mastering the material over the semester while the traditional section experienced the opposite. Also, the students between the two sections stated that they were spending similar amounts of time working on organic chemistry. Although the evidence indicated that active learning led to these improvements, James did recognize unavoidable limitations in the study and alternative explanations for the improvements were possible.

Two sections of organic were provided at the University of Hartford. One was partially flipped while the other was largely traditional lecture. The class sizes were 26 and 28 students respectively. There was no significant differences in SAT scores and GPA’s. Although both sections were academically similar, they were not identical. Both were taught by the same instructor. As much as possible, the same course material, exam and quiz schedule, homework, and review sessions were used for both sections. In the traditional or control section, 85% of the class was spent with lecture. The remaining time was spent working on short problems (5%) followed by a single student called upon to explain the answer (10%). In the partially flipped section, eight topics were flipped comprising 1/3 of the entire semester. The students watched videos on the topics prior to class. To encourage viewing, the students were given extra credit for filling out notes and answering formative assessment questions. This extra credit was only a 0.5% addition to their total grade. In class, students would work in groups of 3 to 4. The first 5-10 min. of the flipped classes was spent discussing and answering questions from the videos followed by an instructor led discussion. The students then worked on 4 – 6 instructor created scaffolded problems. One student from each group

was chosen to present answers on the board. Each section had homework assigned after class.

Although further details can be found in the JCE article, some other observations are worth noting. Students in the flipped section performed better than the traditional section on flipped topics but not traditionally presented topics. Although there were more A's and B's for the flipped section, the overall averages of both sections were approximately the same. Since the withdrawal rate for the flipped section was lower, there were a larger number of lower performing students remaining in the course which could have masked improvements in grades. It was still necessary to emphasize some memorization in order to do problem solving to the flipped section. In the surveys, the students perceived gains in their critical thinking and problem solving skills, ability to transfer knowledge to future courses, and connect concepts. They also felt more comfortable with active learning, peer learning, and the technology used. All of these skills could be carried onto other courses. The majority of the students would take another flipped course if offered. Based on student comments, perhaps the most significant benefit was the ability to ask more questions about the material from other students and the instructor.

Board Members' Picks

Some publications, presentations, and events that caught our interest

From Cathy Welder

I met OrganicERs member Bruce Hathaway (LeTourneau University, BruceHathaway@letu.edu) this past summer at the cCWCS workshop *Teaching Guided-Inquiry Organic Chemistry Laboratories.* Bruce shared a number of ideas with other participants regarding what he has done in his lab courses. He has since published three articles in *The Chemical Educator* that I feel may be of interest to many of us. The articles can be found on the journal's webpage at http://chemeducator.org/tocs/t10021001.htm. Bruce has spruced up some experiments by incorporating a bit of inquiry. In these three experiments, students are given structural variants of starting materials and are asked to make some conclusions based on what they have discovered from their results. I encourage you to take a look!

B. A. Hathaway, D. J. Ball and M. K. McAllister, "Investigating Steric Effects in S_N2 Substitution Reactions: Reactions of Acetaminophen with Alkyl Halides." *Chem. Educator* **2016**, *21,* 223–225.

B. A. Hathaway and K. M. Villermin, "Reactions of Hydroxy– and Alkoxy–Substituted Benzaldehydes with Sodium Iodide and Bleach in Methanol: A Guided–Inquiry Experiment for the Organic Chemistry Lab." *Chem. Educator* **2016**, *21,* 159–161.

B. A. Hathaway and A. I. Mitchell, “Effects on the Endo/Exo Ratio of the Diels-Alder Reaction of Furan with Different N-(Methyl or Dimethylphenyl)maleimides.” *Chem. Educator* **2016**, *21,* 155–158.

Upcoming Events

253rd American Chemical Society National Meeting & Exposition

San Francisco, California April 2-6, 2017

Middle Atlantic (MARM) ACS Regional Meeting Hershey, PA June 4 - 6

Central CERM ACS Regional Meeting, Detroit, MI June 6 – 10

Northwest (NORM) ACS Regional Meeting, Corvallis, OR June 25 - 28

Great Lakes (GLRM) ACS Regional Meeting, Fargo, ND June 27 - 30

cCWCS Workshops 2017

- Mitochondrial Biochemistry, Genetics and Molecular Biology
  University of Puerto Rico Med. Sci. Campus | San Juan, PR
- Implementing iPads in the Chemistry Curriculum Miniworkshop
  Atlanta, GA
- Distance Learning & Hybrid Teaching Miniworkshop
  Denver, CO
- Medicinal Plants: A Healthy Supplement to the Chemistry Curriculum
  Tuskegee University. Tuskegee, AL
- Art as Context for General Chemistry
  Whitman College, Walla Walla, WA
- Materials Science & Nanotechnology, Southwestern College (CA)
  Southwestern College, Chula Vista, CA
- Forensic Science
  Williams College, Williamstown, MA
- Active Learning in Organic Chemistry Miniworkshop, June 12 - 15
  Atlanta, GA

Chemistry Education Research & Practice, Gordon Research Conference, Bates College, Lewiston, Me June 18 - 23

National Association for Research in Science Teaching (NARST) San Antonio, TX, April 22 – 25

100th Canadian Chemistry Conference and Exhibition Toronto (CA) May 28 – June 1