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## **Transforming the sage on the stage into a guide on the side**

Brett McCollum

Brian Rempel took a big risk last year.

As an associate professor in the Department of Chemistry at the Augustana Campus of the University of Alberta, he's well-liked by his students (he has a 4.9 out of 5.0 on a popular professor rating site) and maintaining the status quo would have been an easy option. However, Rempel observed that while his teaching was entertaining it wasn't yielding the level of student success that he desired.

"I have known for a few years that my largely lecture-based model was not working as well as it should have," reflects Rempel. "I could see that students would not typically engage with problems/homework until immediately prior to an exam. By the end of a 75-minute class, I could see that students were getting tired/bored/disengaged. Really, most of the typical problems you would expect from a lecture-based class."

Rempel started tinkering with his instructional approach in his 4th-year enzymology course, blending lecturing with elements from flipped teaching until he found the right balance that aligned with his instructional goals. Seeing success through the actions of his 16 senior-level students, Rempel decided to introduce a similar approach in his larger (62 students) 2nd-year organic chemistry course.

"I was also interested in helping students develop other skills beyond chemistry content. I wanted students to learn to extract information from a written source/textbook. I wanted them to develop some good intellectual habits (reading before showing up in class), time management skills, and take more responsibility for their own learning. In my experience, straight lecture leads students to feel like I am the only one really responsible for their learning."

In my experience, one of the biggest objections faculty have to flipped instruction is certainty that it wouldn't work in large classes. Tell that to Alison Flynn, associate professor of chemistry and 3M National Teaching Fellow at the University of Ottawa. Flynn teaches sections of up to 420 students, using a flipped classroom approach with her 2nd-year organic chemistry and 3rd-year spectroscopy classes. Rather than organizing class time around what the instructor needed to teach, Flynn took an outcome-based approach, focusing her time with students on the knowledge they needed to demonstrate through active methods.

"Flipped takes many different forms", Flynn explains. "The approaches I use depend on the course I'm teaching." Her varied approaches can include pre-class elements: short online videos, video notes, class notes, online tests; in-class activities: think-pair-share, predict-observe-explain, team-based problem solving; and post-class assignments that were graded

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by teaching assistants. “[The] assignments were used to close the loop on learning from the week and were more challenging than the pre-class tests” (Flynn, 2015, p. 202).

In 2014, Scott Freeman and his co-authors at the University of Washington published a meta-analysis of 225 studies on active learning, including flipped classrooms. Their focus was on examination scores and failure rates in undergraduate science, technology, engineering, and mathematics (STEM) courses, comparing traditional lecturing with active learning. Their findings: students in a traditional lecture course were 1.5 times more likely to fail than their peers in an active learning classroom.

Freeman offers an analogy, comparing studies on active learning to medical research. “If the experiments analyzed here had been conducted as randomized controlled trials of medical interventions, they may have been stopped for benefit — meaning that enrolling patients in the control condition might be discontinued because the treatment being tested was clearly more beneficial.”

Let that sink in for a moment. Freeman’s analogy suggests that evidence for the benefits of flipped instruction is sufficient that one could argue that the control conditions, lecture-only instruction, should be discontinued.

As an advocate and user of the approach, I see the benefits in my classroom — from improved reading-habits to the strengthening of peer-academic relationships. Yet, there are challenges. It takes time for students to adjust to the increased responsibility over class preparation. Faculty often need to present data on the efficacy of the method to encourage student buy-in. As students work together in an active classroom, they bond with each other more than they connect with the instructor. This has resulted in documented — and subtle — decreases in student evaluations of their instructors.

For Rempel and Flynn, the transition from lecture to flipped didn’t occur overnight. Both accessed supports on their campus, such as their Teaching and Learning centres. They also connected with internal or external peers for advice. Even if you have a teaching and learning centre on campus, the thought of “drinking the Kool-Aid” and flipping your class may terrify you. Take things slow and keep in mind that the active learning benefits described by Freeman’s analysis represented as little as 10% of class time.

The literature on flipped classrooms and flipped instruction is growing as more faculty accept the challenge of facilitating active learning. Perhaps one of the first considerations is whether you want to use flipping to encourage textbook reading, like I do, or replace your textbook with short online videos as discussed in Jonathan Bergmann and Aaron Sams’ book *Flip Your Classroom: Reach Every Student in Every Class Every Day*. Bergmann and Sams, high school chemistry teachers and US Presidential Award winners, encourage instructors to experiment with active learning pedagogy to find what works for you. Other factors to consider when flipping include the classroom layout and how you will help students establish academic trust with their peers. One professor from Colorado recently wrote to me saying that they were reflecting upon their “remarkable failure of a flipped classroom model,” but

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that reading about the importance of relationships in the flipped classroom was helpful in understanding what they would do differently next time.

Will there be a next time for Rempel? Absolutely. Now that he's found success in applying the approach second- and fourth-year classes, "I will be moving this down to my first-year class as well." It helps that his university is supportive of innovative teaching and risk-taking, but his primary motivation is the increased student success that he has seen through adoption of flipped instructional methods.

*Brett McCollum is a professor of chemistry at Mount Royal University in Calgary, Alberta. His research focuses on effective uses of technology for chemistry education, student development of chemical language and representational competencies, and engagement with students in research partnerships.*