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Keeping Students Active, Engaged

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Keeping students

Students hunch over workbooks or talk quietly in small groups. Brian Gilbert walks slowly around the room, stopping occasionally to lean into the conversation at a table to ask a question.

Gone is the lecture-style general chemistry class. Activities with questions, definitions or problems are displayed on four screens located around the room. Gilbert, an associate professor of chemistry, briefly reviews materials and then gives his students, broken into groups of four, a specific time period to complete a series of questions. Sometimes they are asked to display their work on the board, sometimes they respond orally to questions.

The Gilbert File

At Linfield since 2001

B.S. University of Arizona

Ph.D. Indiana University

Post-doctoral fellow, Massachusetts Institute of Technology

Prior teaching position:

Coastal Carolina University

Academic interests:

Experimental physical chemistry and nanotechnology, including characterization of the physical and chemical properties of nanoparticles, Raman spectroscopy and surface-enhanced Raman scattering.

Welcome to POGIL, Process Oriented Guided Inquiry Learning. While the name may be a bit dry, the technique is anything but. Gilbert was introduced to it nearly 10 years ago and has become a staunch advocate.

With POGIL, interactive learning replaces the traditional lecture-style classroom. Students work collaboratively in small groups to answer a series of questions that are based on a model – perhaps data they have to interpret or a diagram that represents a chemistry theory.

“Students are always active in the class,” Gilbert said. “My job is to facilitate their answers, get them through the activity and make sure they understand the main points.”

Students are engaged and as Gilbert walks around listening to them work, he often stops to answer questions. If the same question pops up in different groups, he stops the class to discuss a specific point or aspect of the exercise.

“I have a much better sense of where individuals are, especially in a 40-student general chemistry class, than I did before,” he said.

The most important message that Gilbert wants to convey to students is that science is not a series of facts and numbers and things to be memorized.

“It’s really a way of thinking about questions that anybody can do if they are willing to spend the time, energy and have the interest,” he said. “And with the introductory students, I’m setting up the course in a way that forces them to study the way they need to.”

From German to chemistry

Gilbert did not plan to be a chemist. He entered college as a German major but soon found chemistry classes more intriguing.

“What I liked most about chemistry was working in the labs and finding out that even as a sophomore at a major

research university, I could conduct research on real projects,” he said. Gilbert learned that he was really good in the lab, tinkering with instruments and spending time making things work. He spent one summer working at a gold mine in Nevada developing a new gold assay for the company and another with a major chemical company in Germany doing organic synthesis. At MIT he was involved in some of the first research projects through the Federal Aviation Administration (FAA) on how to detect high explosives in airplanes, following the bombing of Pan Am 103 over Lockerbie, Scotland.

That experience solidified his commitment to the value of undergraduate collaborative research, which continues to energize him. During his time at Linfield, he has mentored some 43 students in such projects.

“If a student is really interested in science and being a scientist, none of the coursework can prepare them for what that means,” he said. “The only way you can be sure is by getting into a lab and working on problems that are ill-defined and for which we don’t know the answer.”

Students and faculty are collaborating on questions for which they are interested in finding answers. At Linfield, students can start doing research as freshmen and by the time they enter graduate programs they are better prepared than many of their peers.

Now instead of just gaining that research experience in the summer, students have an opportunity during the regular academic year. After Gilbert’s sabbatical in 2009, the chemistry department designed a series of research courses so students can earn credit for research and hone their skills in fall and spring semesters.

Finding his place in the classroom

What began as a practice application for a job resulted in Gilbert’s first teaching position in South Carolina.

He quickly found teaching was a

active, engaged



perfect fit. He liked interacting with students and enjoyed helping them grow in their understanding and abilities. One of Gilbert's biggest challenges is keeping a broad range of students – including majors and non-majors and freshmen through seniors – engaged and learning.

In addition to teaching rigorous courses such as physical chemistry to majors, Gilbert also leads general chemistry, laboratories and instrumental methods, where students learn how to use various chemistry tools. He taught a January Term study abroad class in Chile with Jackson Miller on The Science and Discourse of Global Climate Change. But it's his January Term class, The Art and Science of Brewing, that captures the attention and imagination of majors and non-majors alike. Gilbert designed the class as a way to teach non-science majors chemistry in the context of something they were interested in. It has become one of the most popular January Term classes and it often has a waiting list of students eager to enroll.

"There's so much great fundamental chemistry involved in brewing, such as how temperature and pH affect the action of proteins and how heat and time in a reaction affect the rate of conversion of compounds," Gilbert said. Students analyze the chemical processes that occur at each stage of brewing and learn how organic compounds help create aromas and flavors.

Teaching requires being adaptable and really caring about the success of students, which means finding techniques to reach them regardless of background and knowledge. "I think it's dangerous to think that if you lecture all the time that the same lecture will always work with different groups of students," he said.

Gilbert's ability to engage students in discussion complemented his lectures, according to Katie Sours '10, who just completed her master's in public health



Brian Gilbert, associate professor of chemistry, talks with students in a general chemistry class. His teaching style is more interactive than lecture-style and is based on a system called POGIL, Process Oriented Guided Inquiry Learning. The teaching style encourages students to work collaboratively in class and keeps them more engaged with the material.

and is currently working as a lab instructor for organic chemistry and physiology at Linfield.

"Brian's lessons helped me develop critical thinking skills and the comfort and ability to ask questions," she said. "Discovering why and how chemistry works from the ground up pushed me to do the same in other courses at Linfield, gave me an advantage in my graduate studies, and has contributed to the skill

set I use outside of school."

Gilbert's willingness to meet with students individually helped Sours understand concepts she couldn't grasp during classes. "We applied math, physics and other chemistry concepts to derive formulas and concepts from their roots," she added. "This enabled us to really understand how they worked." 🍄

– Mardi Mileham