To Lecture or Not to Lecture is Not the Right Question

It is nearly impossible to spend time in the Knowles Teaching Fellows Program and not become involved with the notion of inquiry as a foundational component of one’s teaching practice. Practitioner Inquiry as described by Cochran-Smith and Lytle is defined as the intentional inquiry by teachers about their own school and classroom work (Cochran-Smith and Lytle, 1993). Each year, the process of integrating inquiry into both the big picture planning and the daily routines of the classroom is scaffolded for new teachers, building their toolbelt of effective teaching practices. In year one of the Fellowship, we focused on understanding the inquiry process and how to leverage our reflections to help create learning opportunities for students in our specific disciplines. Year two challenged us to develop agency in pursuing our own inquiry questions related to our classrooms and to design data collection methods that would produce meaningful information to guide our teaching. Throughout year three, we designed and implemented our own inquiry cycles in our classrooms and used the data we collected to make tangible changes to our practice throughout the school year. In this third year of growing our capacity to study and reflect on our own practice, we were also asked to consider our unique inquiry questions in light of equitable teaching practices to ensure that the evidence-based changes we made to our practice were effective for all students in our classrooms. As my cohort has transitioned into phase two of the Fellowship (years four and five), our inquiry and knowledge generation from the first three years is beginning to and continuing to propel us into positions of teacher leadership, where we are asked to invite the collective knowledge and expertise of our colleagues into our inquiry.

As I am about to enter my fifth and final year of the Knowles Fellowship, I have found myself pursuing different lines of inquiry in my classroom in much less formal ways than a full-fledged inquiry cycle. To me, inquiry has become an intentional and systematic reflection focused on my teaching practice that centers the creation and improvement of learning opportunities for my students. More practically, inquiry has become the subtle adjustments in the grouping of students, the order of materials presented, the types of questions asked to introduce a task, or any of the adjustments made to better learning outcomes for students. The scaffolded approach to understanding and engaging in inquiry presented by Knowles has helped me to see that teachers use different aspects of the inquiry cycle every day in their classrooms for both short-term interventions and long-term changes. I have also learned that the inquiry process does not always lead to a polished conclusion, but often serves as a launch point for even more questions.

A major inquiry of my teaching career so far has been discovering the most effective balance between lecture-centered delivery of instruction and the seemingly more innovative teaching strategies taught in graduate school, such as argument-driven inquiry, phenomenon-based modeling, or applying the engineering design cycle using the NGSS practices. In my first few years of teaching, I carried the notion that every day in my high school chemistry classroom had to be discovery oriented for my students. If I could design an activity interesting and meaningful enough, students would be able to uncover the foundational truths of chemistry and be able to apply their knowledge to phenomena they encounter in their daily lives. While this mindset helped to create a few intriguing unit plans, I found that it was also mentally and sometimes physically exhausting to prepare the perfectly scaffolded and differentiated lessons for all students to uncover the learning goals for the day. Not to mention, sometimes a large portion of my students still didn’t quite understand what they were supposed to learn after a week of investigatory tasks.

After transitioning from a large co-ed public school to an all-girls independent school, my belief in a highly inquiry-based approach to teaching chemistry was further challenged by a new science department and school-wide pedagogy that emphasized more teacher-centered lecturing as the primary mode of learning for students. While I still truly believed in the power behind many of the research-based, student-centered teaching strategies employed during my first few years of teaching, I also noticed that there were students who genuinely loved learning from lectures and sometimes gleaned greater understanding from a well delivered lecture in comparison to an inquiry task. At the end of my first year teaching at my new school, after a sequence of units that employed phenomenon-based modeling, argumentation, hands-on pattern recognition, and a series of discovery-oriented tasks, my students gave me some enlightening and hard to swallow feedback in the form of mutiny against participating in any more discovery-based group work. After all of the intentional thought that went into designing the carefully layered activities, students across all classes asked for more opportunities to learn through taking their own individualized notes.

I shared my frustration about the over-emphasis on lecturing with my Knowles

Program Officer for Teacher Development and my Knowles coach at the time and expected both parties to have my back and offer support with regard to doing everything that I could to avoid lecturing and to keep my curriculum full of exciting and enlightening inquiry-based tasks. However, their response was quite the opposite and has proven to be one of the most pivotal conversations in the development of my personal pedagogy. My Knowles mentors at the time questioned my own ability to learn from and enjoy a well-written lecture. They helped me to see lecturing as a parallel to storytelling and as another skill to hone in my teacher tool belt, rather than a tactic to avoid at all costs. This conversation started a yearlong personal inquiry to uncover what an engaging lecture looks like in a high school setting.

For the past year, I have traveled to several of my colleagues' classrooms to observe the components of a well-designed lecture—one that captivates student attention, provokes students to ask challenging questions of themselves and the world, and, of course, meets the learning objectives of the day. Many of the teachers I have observed I would have initially described as "traditional" or even "old-school" in their pedagogical approaches, but what I found was that students in their classrooms were not only learning, but also raving about the stories that their teachers shared as components of their lectures.

I spent several weeks observing one legendary history teacher in particular. Every class period is an 80-minute storytelling conversation with his students with the flexibility to travel in the direction of students' questions or shared experiences about the topics of the day. I have seen students become enraged at King Henry and the treatment of his six wives as though it was the latest Netflix series scandal. I have watched genuine student-led questioning and conversation of how their own current churches differ, operating on either a Catholic heritage or the Protestant reformation, and where their own families landed religiously after immigrating to the United States. I have even witnessed students integrate their own stories shared by their great-grandparents into a lecture on the origins and outcomes of the American Civil War. From this narrative-oriented lecture approach to learning, students were arguing ideas from evidence and integrating content from class with their personal experiences. Additionally, they were identifying patterns in history, and imagining how the future could be different with their newly obtained knowledge—all skills that I was trying so hard to build in my students through my use of non-lecture teaching strategies, all skills that contribute to a deep learning of science.

These observations have led me to start developing my own bank of stories to integrate into my own teaching of chemistry. Some of my stories I have simply picked up over time throughout my own study of the discipline, some have come from intentionally seeking out ways to make the study of chemistry come alive for my students, such as the story of the Radium Girls.

The Radium Girls are known as a group of women who worked at the United States based Radium Dial Company in the early decades of the 1900s. With the recent discovery and isolation of radium in 1902 by Marie Curie, the glowing and unknowingly radioactive substance quickly became a widely used material in the prewar American lifestyle. At the Radium Dial Company, women were hired into a seemingly lucrative occupation to paint the small numbers of watch faces with paint that contained radium. The numbers of these watches would then glow in the dark due the radioactive nature of Radium atoms, which created a high demand for the utility and luxury of radium-painted watches and items. At this point in the history of atomic theory, radioactivity—or the instability and high proton:neutron ratio of the nucleus of an atom—and its consequences was only partially understood by scientists, much less the general public. It wouldn't be until years later that Marie Curie would notice signs that the radioactive vials of radium that she carried to conferences around the world actually burned her hands and deteriorated the internal structure of her body. For the women at Radium Dial Company, their day-to-day job required them to place a very small paint brush repetitively in radium-based paint, onto the face of a watch, and then between their lips in order to make a fine point to the brush to match the finite detail of the numbers and to not waste any additional paint. Due to the delayed impacts of radioactivity and the total disregard for safety by the corporate leaders of Radium Dial Company, many of these women continued the "lip-dip-paint" nature of their work, even after their bodies began showing the incredibly severe impacts that high levels of radiation have on human tissues and bones.

Sharing the story of The Radium Girls with my students this past semester not only created an opportunity to discuss the ethical responsibilities that scientists hold with the knowledge they generate, but it also opened up conversations about the gender-dynamics of the time, how they compare to the present context of scientific discovery, and the interwoven nature of scientific discovery, profit, and production. This emotional narrative was initially shared in a unit unraveling the structure of the atom and the sequence of findings that determined what we now know to be the structure of the atom, but the story has since served as a memory peg or launch point for any time the idea of radiation or nuclear stability comes up in my high school chemistry classes.

As I move forward in my teaching career, I hope to develop a library of meaningful stories to share from my own primary sources that recount personal experiences from having visited locations where major discoveries have occurred in relation to chemistry and where the current boundaries of knowledge continue to be pushed. With this goal in mind, as well as with a suitcase of questions from my current Honors Chemistry students, I am planning to obtain grant funding through my Knowles Teacher Initiative Fellowship to travel to and tour the European Organization for Nuclear Research, also known as CERN, in Geneva, Switzerland. CERN is known as the largest particle physics laboratory in the world and the work done in this historical institution intersects with chemistry at the focus on understanding the atomic nuclei and the behavior of subatomic particles that make up the nuclei. The earliest iteration of CERN was developed in the early 1950s and was initially directed by Niels Bohr—arguably one of the most pivotal figures studied in our high school chemistry curriculum. As both the organization and the research progressed, CERN developed to include other significant figures studied in introductory chemistry, such as Werner Heisenberg. While the earlier goals of understanding nuclear chemistry have now expanded to focus more on high energy physics, the historical significance and current explorations provide pertinent narratives to share with my students as they build their own understanding of the atom in their high school chemistry class. Questions such as, “Why does the electron have no mass?”, “Is it actually possible to reach absolute zero?”, “How did scientists even start to figure out this stuff?”, and most interestingly, “Where were all the women?” are asked by my students every year as we study the history of atomic theory and the implications for the characteristics of subatomic particles.

In my travels to CERN this spring and in my continued personal inquiry of developing and integrating the dramatic history of chemistry into my curriculum, I hope to provide a wealth of narratives that support my students in grappling with the concepts and significance of the ideas that compose the foundation of chemistry. I hope to show my students the increasingly diverse group of scientists that are contributing to current research and pushing the boundaries of knowledge into uncharted territory. I also hope to reveal that chemistry is a discipline full of current and active discovery, rather than a collection of theories that have been solidified for a hundred years. My own personal theory, developed after my year of inquiry and observation, is that through the incorporation of well-designed lectures with intriguing primary or secondary sourced narratives, my students will learn not only to master the equations of chemistry, but to understand the value and potential that their own questions and wonderings have in the broader scientific community.

What have your students been wondering about and how can narrative storytelling help you bring their wonderings to life?