Discovery, Curiosity, and the Ways We Learn

As an educator, I thrive when engaging students and helping them connect with complex scientific concepts through learning techniques that inspire discovery and cultivate curiosity. All of us remember some point in our childhood where the thrill of discovery and our innate curiosity made us insatiable learners. For me it was dinosaurs, birds, seashells, rocks, and fossils – I absorbed information like a sponge and found immense pleasure in collecting and disseminating it, much to my parents' chagrin. Later, as a science education specialist in elementary schools in Tacoma, Washington, I witnessed this same childhood passion for knowledge in nearly one hundred classrooms and over a thousand students. These experiences have led me to believe that learning is most rewarding and effective when it is driven by internal motivation instead of external rewards. To this day I maintain that our curiosity and the satisfaction that comes from independent discovery is what inspires the pursuit of new information for learners of all ages. Now, as a university instructor, I continue to embrace a pedagogy that derives from constructivist and experiential learning theory – one that focuses on student-centered lessons that encourage sustainable, independent inquiry. I do this through active and collaborative learning exercises, flipped classrooms, and transparent, backwards-designed curricula.

In all of my classrooms – whether in a large lecture hall, small laboratory, or a digital space – I believe that active learning is essential to crafting an effective lesson plan. In a 150-student botany class, for example, I have utilized a simple "turn and talk" exercise that encouraged students to make connections between new and old content and increased overall participation and engagement. In these activities, students were asked to collaborate with a classmate to construct a table of floral traits that distinguished the family of plants that we were currently discussing from a similar family we had discussed previously. This would engage students directly with the lecture material while simultaneously generating a practical study tool for reference later.

In contrast with these large, upper-division botany classes, my small, digital introductory biology course for non-majors required me to craft unique active learning exercises that were personalized according to my students' individual interests and backgrounds. In a session on biotechnology and genomics, for example, I asked my students to find and watch a TED talk video about the modern applications of these technologies, then provide a brief summary for the class and discuss its impacts on society. My students, who had backgrounds in the humanities and psychology, were so engaged by the activity that they independently researched the subjects later, driven by their own curiosity and the satisfaction of discovery. In all contexts – be it online, in the classroom, or in small groups – these active learning exercises encourage higher-order thinking and promote deep learning through personal connections, and I always strive to include them in my lessons.

Importantly, however, I have found that adult learners are quick to fatigue from "busy work" or disingenuous learning strategies that are not obviously relevant to their success in the classroom or beyond it. So, because not every learning opportunity can inspire every student, I also design all my coursework and activities "backwards" such that they are clearly and transparently outcome-oriented. This means that every assignment I create has clear and consistent expectations outlined in a grading rubric. Every active learning exercise in the classroom is validated by the testable learning goal it helps to satisfy. Even traditionally intangible assignments like readings and discussions are directly incentivized by points that can be earned through satisfying unambiguous and demonstrably relevant objectives. This type of backwards-designed and transparent curriculum gives students the feeling of control and agency over their success that sustains their motivation to discover, stay curious, and learn.

In addition to active learning and backwards-designed learning experiences, I recently taught three introductory biology courses in which I utilized a flipped classroom design. This unconventional teaching style is highly effective in smaller classrooms and with non-traditional students, and I love to incorporate it whenever I can. Flipped classrooms utilize digital platforms to provide students with the materials to learn core concepts independently, before meeting in a class session. Once students have familiarized themselves with the lecture material online, our classroom session provides an opportunity to receive clarification or work through advanced concepts together. This helps to facilitate in-depth discussions and higher-order thinking in the classroom which further promotes deep learning. Overall, it transforms a traditional professor-student relationship into a collaborative, personalized tutor-like experience in which most students thrive.

Ultimately, I seek to ensure that each of my students succeeds and feels validated by the work they have put into our class. Regardless of my preferred pedagogical practices, I always take the extra time or effort to check-in with a student who does not appear to be thriving in these learning settings. In addition, I design all of my curriculum with inclusivity in mind – whether through an intentional and enhanced representation of research by female scientists or scientists of color, or through discussions of how race, gender, sexual orientation, or society have impacted scientific research and discoveries. My own experiences in the LGBT community have improved my awareness and appreciation of these topics, even in a science classroom. In teaching my introductory biology classes, for example, these discussions always increased class participation and engagement, and I found them to be a valuable component of my students' learning experiences. Every student has a unique background and I always strive to ensure that no one feels excluded from the culture and process of science and science education.

In the past few years, my teaching style has evolved substantially – first through trial and error, then through professional development and training, and eventually through the inclusion of modern, peer-reviewed and inclusive learning techniques. As a result, my students perform better and respond more positively to my curriculum today than they did when I crafted my first large lecture course over five years ago. I am eager to further hone my skills as an educator, but in the meantime, I will continue to design coursework that inspires discovery and cultivates curiosity – traits which unify insatiable learners of all backgrounds.