Teaching Philosophy

Jessica Sutter, Department of Physics and Astronomy, University of Wyoming

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As an educator, my main goal is to help learners build knowledge and curiosity about the universe around them. In order to achieve this, I believe the most important quality I can bring to any classroom is my passion about the subjects I teach. I hope to get my students excited by clearly displaying my own love for the subject. I also strive to provide a wide variety of research-based teaching tools to engage students and help them grow as scientists. With the combination of stimulating activities and my love for science, I believe I can help students gain not only proficiency in the material but also a strong desire to learn more.

Throughout my career as a graduate student, I have striven to take every opportunity I could to learn more about how to be a better teacher. During my first year, I quickly realized that finding new and innovative ways to teach was my passion. This led to my participation in a vast array of faculty learning communities, conferences, workshops, book and journal clubs (including one that I started within my department), and discussion groups focused on how we can apply new research to foster better learning outcomes. Through participating in these programs, I became more certain that my place is in the classroom. I have also learned a variety of skills and techniques that I have been able to apply to my own teaching experiences so far, including how to incorporate active learning, the benefits of backwards design, and how to build more inclusive spaces for learning.

Through these experiences, I developed the belief that it is imperative that my students have as many chances for actively participating in the learning process as possible. Multiple studies have shown that the greatest learning occurs when students are trusted with the opportunities to build their own knowledge, with the instructor playing the role of 'guide on the side' instead of a 'sage on the stage'. One example of my efforts to bring these strategies to the classroom is an introductory physics lab manual I co–wrote with my advisor. In one lab, students were asked to develop their own experiment to determine the specific heat of three different materials using the tools we provided. In asking the students to design the experiment instead of providing a step–by–step cookbook, the students were forced to think about what they would need to do to measure specific heat and how that related to the concepts we discussed in class. I suggested that we supplement the lab with a challenge for the students in order to relate their work to the real world. Once the students had determined the specific heat of each material, they had to decide which material would be best for building a steam heating system in a new classroom. Adding this question forced the students to pause and consider how the specific heat of the materials would change how the material would behave at very high temperatures. This sparked discussions among the lab groups about what the specific heat actually measured and how this would affect their decision. These discussions helped the students understand what they were actually measuring and how those measurements are applicable to real world problems.

My belief in the power of active learning was further cemented in my pedagogy when I participated in the University of Wyoming Science Initiative's Learning Actively Mentoring Program (LAMP). This program begins as a one–week intensive workshop, where faculty and graduate students from across Wyoming work together to design individual projects that incorporate new active learning techniques into an existing course.

This is then followed by a year of workshops and sharing the results of our projects. My experience in this program was fundamental to my teaching philosophy. Throughout this program I learned about the wide variety of proven strategies for increasing learning gains in all students. I was also able to collaborate with the mentors who would become my guides as I developed as an instructor. Shortly after my participation in the week–long session, I began teaching my first course as the principle instructor. In this summer introductory astronomy course, I was able to put into practice what I had just learned by developing new activities and labs and monitoring the success or failure of these activities with a carefully tailored assessment strategy.

In addition to active learning strategies, this program first introduced me to the principle of backwards design. Backwards design instructs educators to determine the learning outcomes of a course before all else, allowing every choice the teacher makes to be informed by the desired course goals. By initially deciding that my ultimate goal for the introductory astronomy course was my students leaving my classroom with an increased understanding of scientific thinking, I was able to structure all of my activities and labs around students working through major discoveries in the role of scientists. Students were tasked to answer questions like 'what is the composition of Saturn?' and 'how can we measure the age of the universe?' by applying appropriate astronomical research techniques. At the end of my course, I was thrilled to have students asking me questions about *how* we know what we do, showing that they had begun to grasp the importance of seeing science as not a set of facts, but as a process to increase our understanding of our place in the cosmos.

Backwards design has also helped me create well-aligned courses. Alignment between what I teach, what I hope students learn, and what I measure in tests and homework assignments helps me create learning environments where students are able to grow and clearly exhibit that growth. For example, in my introductory astronomy course, where I hoped to help students develop a knowledge of scientific process, test questions focused on having students design experiments to measure the age of the moon or specific properties of an imaged galaxy. Both these questions had clear links to the material we covered in labs, lectures, and in-class activities, but also required students to use their knowledge of how scientific experiments are designed. By clearly communicating my goals for the course to the students and aligning my assessment methods with these goals, I believe I created a space where students felt encouraged to learn and grow, instead of just acquire a desired grade and move on.

In addition to my work in my own classrooms, I was able to return to the LAMP program as a mentor in the summer of 2019. As a mentor, I helped teach faculty and graduate teaching assistants about how to implement a wide–variety of active learning strategies. My role was as a dedicated guide for graduate teaching assistants. In this role, I helped brainstorm ways these teaching assistants could supplement their courses to help students achieve greater learning outcomes. I also encouraged them to consider how they could evaluate the success of these changes through targeted assessments. The implemented changes ranged from shifting how physics discussion sessions were moderated to implementing reflection strategies in labs to fully flipping portions of a course. Being a mentor in this program has taught me how to assist faculty in their own growth while also holding them accountable for documenting and sharing the fruits of their labor.

Through expansions on this program, I have also been able to led a workshop at The Original Lilly Conference on College Teaching. This conference is one of the nation's most well–renowned teaching conferences, so the opportunity to share my own work there was incredibly exciting. During my session, I led educators from around the country in an exercise where they were tasked with taking one of their favorite discoveries from their field and molding it into an experiment that even a beginner student could accomplish. This was based on my own work developing astronomy activities for non–major students. Getting the chance to work with enthusiastic educators from around the country was an amazing experience, and I was able to learn more about the best teaching practices through the many sessions I attended.

Recently, I have had the opportunity to put these practices into play while teaching as a visiting

professor at Whitman College. As I taught in the Fall of 2020, all of my classes were remote and I had to transition to teaching online. In order to keep students engaged, I made sure to include plenty of poll questions and activities in each class. Students in both my introductory astronomy course and my upper–level galactic astronomy course worked together to build knowledge and study the universe. In the introductory course, I created a system of science badges the students could earn that allowed each student to design their own timeline and path through the material. This helped students who might have otherwise been overwhelmed by the change of learning style focus on what interested them and find how they could fit this course into their schedules.

In the majors course, I got to work with students in the field I am most familiar, extragalactic astronomy. This allowed me to find new and creative ways to involve the students in my own research. To do this, I created two research–based assignments in which students analyzed Sloan Digital Sky Survey data to find the fluxes of nearby galaxies and apply spectral energy distribution fitting to these fluxes to measure other galaxy properties. In each class meeting, we would build on our knowledge through programming activities in jupyter notebooks and really dig into what being a practicing astronomer looks like. The students in this course entered with various levels of experience in coding, from many who had never worked with a computer program before to a few who had completed multiple programming classes and projects. By designing activities that first stepped students through the data analysis process then tasked them with replicating the work on a similar problem, all students were able to grow as astronomical coders. I was also excited to see that at the end of the semester multiple students noted on their course evaluations that the main thing they wanted was more programming activities throughout the class. As astronomy research has become more and more dependant on computer programming, I believe it is essential that astronomy courses reflect this. It would be a disservice to the students to send them out into the world of astronomical research without first giving them the tools to complete this work.

Uniting all these practices has helped me create classrooms where all are able to pursue science. As a woman in the traditionally male-dominated fields of physics and astronomy, supporting a diverse student population has always been an important goal of mine. I believe my philosophy supports this goal in a variety of ways. By providing activities in which students get to perform the roles of scientist, engineer, or researcher, students who may not have many role models who look like themselves are able to see themselves working in the field. By incorporating a variety of activities into my courses, students who may not excel in lecture halls are given alternative methods for learning the materials. Further, by clearly stating and aligning my goals for the course with forms of assessment like quizzes and exams, test anxiety and stereotype threat are reduced. One of my deepest hopes is that some day everyone will feel welcome to participate in scientific fields. By applying these methods in my classroom, I can help move us closer to that goal.

As I try to encourage and engage all my students, I also strive to remember what it was like to be an undergraduate student. By approaching the subject and responding to students the way I most appreciated when I sat at their desks, I hope to create an environment where students feel comfortable asking questions and learning without stress. This is the atmosphere I strive to create in all of my classrooms, regardless of size, subject, or standing. My greatest joy as an educator has always been the moments in which I see my students embracing the subject and testing new ideas without fear!