

1. **If you could teach any of the existing introductory or general education courses at Ithaca College, which course would you choose, why that course, and how would you use the SCALE-UP classroom in tandem with active-learning pedagogies to best engage students?**

I would use the SCALE-UP classroom to teach Solar System Astronomy, because there are so many opportunities in this course for long-term, student-led investigations that can be used to develop students' curiosity and self-direction.. I would plan to center the course around the use of the observatory as well as photographic exploration of day and night sky in order to engage students in the hands-on nature of real scientific research, from exploration and hypothesis construction to data acquisition, data analysis, and the communication of results.

The design of the classroom is ideal for forming students into research teams for several month-long investigations. Toward the beginning of the semester, I would anticipate accustoming students to group work by having them warm up at the beginning of the class by working together to answer open-ended questions like 'As short lived humans, how do we know that the sun is billions of years old?'. As they became more comfortable with each other, I would use the design of the classroom to have small group debates on topics like the layout of the solar system and the definition of a planet. Students would individually research the historical arguments that were made, then work in pairs to compile evidence on both sides, debate this with each other in groups, and then present out to the class to. Having the students lead exploration of these topics will put them in control of forming a deeper understanding of not just these concepts but how we construct astronomical knowledge.

A few weeks in, I would begin facilitating student-led investigation by having students in different groups make long-term regular observations of a particular phenomenon (the position and phase of the moon, the position of the sun, the location of sunspots, or the position of the stars and planets). We would spend time each week in small groups combining and discussing the data collected by the group. Students in the group would assume different roles of tabulating data, revising their hypotheses, and sharing updates on their findings with the class. Later in the semester, students would work in pairs to write proposals to use the observatory, and would then work as a group to evaluate and choose a project to complete together. The available projectors would allow students to be able to show their laptop screen and work efficiently together to analyze images. The projectors would also allow students to work together to both write and practice a formal final presentation to communicate the results of their investigation with the rest of the class.

2. **Consider a single experimental or observational project you would conduct at Ithaca College and publish in a peer-reviewed research journal in your field. Describe how you would integrate undergraduates into all stages of the project. Include how you would train and mentor students to meet with success. What resources would you need (e.g., laboratory space and equipment) to complete your proposed project?**

A research project that I anticipate conducting at Ithaca College is to better understand the 3D location of gas clouds in the center of the Milky Way Galaxy. The overall goal of this project would be to compare infrared star counts observed toward individual molecular clouds with models of the 3D stellar distribution in the nuclear bulge to place clouds on the front or back side of gas orbits in the Galactic center. This is an excellent project for including multiple undergraduates, helping them develop the ability to work well in a team.

One student would focus on simulating the 3D location of stars in this region. This student could start by reading literature and compiling information on the stellar structures in this region. They then would write a code to construct a toy model that would encode information on the positions of individual stars with respect to a reference frame like the central supermassive black hole. The next step would be to produce simulated images of the model, including an object in different positions that would block the background stars, with the ability to view it from different angles.

A second student would focus on examining astronomical images of the Galactic center. This student would start by learning about celestial coordinates and how to determine the positions of objects on the sky. They would then search online archives for astronomical data on the Galactic center region. I would have this student learn how to work with software to view astronomical images. They would then write a code to count the number of stars toward each cloud in the images.

While the students could begin their projects independently, they would ultimately work together more and more, for example, together learn a common programming language. At the end, I would have both students learn about statistical methods like chi-squared for comparing observations and models, and they would work together to determine where they to put a cloud in the first student's 3D stellar model in order to best reproduce the second student's observed star counts. I would plan to have both students present a poster on their results at a professional meeting, and to have them ultimately work with me to co-author a paper on the results, each helping write a description of the analysis they led.

As part of this work, I would have weekly one-on-one and group meetings. At least monthly, I would use the one on one meetings (in a neutral space like a campus coffee shop) to give and receive feedback. For example, what does the student think they are doing well? What is something they are having trouble with? What am I doing that is helpful? What am I doing that is less helpful? I would use this regular check in process to help student improve their ability to communicate and to become more skilled at both giving and receiving feedback, as well as to help me tailor my mentoring strategies to the individual needs of each student. For the success of this work, it is important to have workspace with computing facilities that students have independent access to. This lab space would also need to be conducive to group work (e.g., having round tables and a projector screen).

- 3. How would you support traditionally underserved and underrepresented students in your research, teaching, and academic advising? Please offer specific strategies or examples.**

There are many strategies I use to support students from traditionally underserved and underrepresented populations as a teacher, mentor, and research advisor. As a research advisor, I prioritize spending time to help students prepare and improve their applications for summer research internships, bridge programs, and graduate school. I share knowledge that I have accumulated to help prepare for and succeed in different career stages. I work to be a champion for the excellence these students already possess: take time to celebrate students accomplishments, and to nominate them for career opportunities. Most importantly, I emphasize holistic professional development, including discussions of the many issues outside of research and classes that may be impacting students, including work-life balance, mental health resources, and how to combat impostor syndrome. As an advisor at Ithaca College, my students will be a priority in my schedule, and I will work to build a relationship where they are comfortable discussing their needs for success, not just as a researcher in my group, but as a student in and outside of school.

As a mentor, it is key for me to connect students with a network of mentors. I am not a role model for every student nor can I relate to all aspects of my students backgrounds. At Ithaca College, I will continue to use my professional contacts, the seminar series, and student attendance at conferences to connect undergraduate students with an array of mentors who can help create a community of support. It is my goal to build lasting relationships between students, mentors and role models, providing students with targeted professional development, and creating a safe community for the discussion of challenges and roadblocks to equal representation. In the past I have addressed these goals by training local advisors in effective mentoring techniques and making space for significant extracurricular interaction with students (dinners at my home, camping and rafting trips). At Ithaca College I plan to begin applying this community model through a monthly equity, inclusion, and social justice journal club, in which students and faculty can discuss these topics and learn from each other.

As an instructor at Ithaca College, I plan to expand the 'Professional Physics and Astronomy Seminar' course to better reach and support a diverse student population, based on my experience running a similar workshop series to help undergraduate students from underrepresented groups at San Jose State succeed in STEM fields. The goals of this series were to connect students with information, resources, and strategies to succeed at various points in their undergraduate career, from their first STEM class to finding research to planning their path after college. I plan to apply this experience by first designing a workshop series, complementary to the existing Physics and Astronomy Department seminar course, for non-majors and prospective majors on how to succeed in their first physics or astronomy class, as a way to reach, support, and recruit more diverse students. I will also work to coordinate the seminar course series with other departments to help potentially isolated students make connections with peers with similar backgrounds and experiences. Finally, I also will bring to this course an emphasis on community and cultural values, to give less prominence to a deficit model of underrepresented students being lacking in preparation and subject to additional barriers, and to focus instead on helping students identify and recognize the unique strengths they already bring to a pursuit of excellence in physics, astronomy, and science in general.