

I believe that student success requires deliberate attention to multiple dimensions of a course, including **effective instruction**, **welcoming learning environments**, and **supportive course policies**. My teaching and research experiences at the University of Illinois Urbana-Champaign have equipped me with both the mindset to care for students and the skillset to support them. I have co-instructed two computer science courses at Illinois: Computer Architecture (~280 students, flipped and collaborative) and Discrete Structures (~50 students, remote lectures). My research spans various aspects of CS education, such as investigating student difficulties, observing collaborative learning dynamics, and evaluating course policies. As an instructor, I am committed to integrating my teaching and research experiences and expertise to create student-centered courses where they can flourish, persist, and succeed.

Understanding Student Difficulties for More Effective Instruction

Whether it is traditional lecturing or active learning, the instructor's ability to effectively explain ideas plays a crucial role in students' understanding. Because instructors and students tend to have different expertise levels, experiences, and perspectives, it is not always easy for instructors to communicate knowledge from their minds directly to the students, resulting in ineffective teaching. Effective instruction necessitates a firm understanding of students' knowledge and difficulties in their courses. To facilitate effective instruction, I will leverage my teaching experiences and research on student difficulties in various CS concepts, from which I draw insights to improve my instruction to better facilitate learning.

I believe there is no single best way to teach, as students' diverse backgrounds, learning paces, and perspectives suggest that what works well for some may not work for others. As a result, I prioritize gauging students' understanding and refining my instruction to ensure clarity and inclusiveness in my class. When teaching Discrete Structures at Illinois remotely, I regularly paused during lectures and asked students to utilize Zoom reactions to inform me whether they had any questions. When students were stuck, I walked through their thinking process to pinpoint the bottlenecks, rephrased explanations, and/or approached from different perspectives. My ability to explain things has been well-received by the students in the course evaluation surveys, and I have been recognized as a Teacher Ranked as Excellent By Their Students for both courses I co-instructed ("He is a very reliable TA, which always answers students' questions with sufficient explanations. [Discrete Structures] is a hard class, and there are a lot of concepts going on, but [Hongxuan] can somehow figure out a way to explain the concepts to students.").

Besides real-time, in-class interactions with students, I investigate and address student difficulties using research methods and instincts. My research in CS education has equipped me with methodologies for understanding student difficulties, which I apply in my classrooms to improve instruction. For example, in our work on *graph layering*, a data modeling technique for algorithm design, we 1) conducted think-aloud interviews to identify students' conceptual challenges, 2) designed scaffolded problems and reading materials to provide targeted support,

and 3) evaluated the effectiveness of these approaches through experiments. Findings from these studies have led to concrete and permanent improvements to the algorithms course at Illinois, including changes in pedagogy, new course materials, and new assessments. Following the “identify difficulties — proposing solutions — evaluating interventions” pipeline, I apply my research skills and mindset to improve instruction. In Discrete Structures, I proposed and executed the idea of reviewing students’ discussion problem submissions and compiling a list of common mistakes with comments and tips to help students prepare for their weekly exams. Students told me during office hours that they appreciated knowing that their difficulties were shared by others and valued the tips we provided for addressing them.

I am committed to refining my instruction by investigating student difficulties—both informally in the classroom and rigorously through research—and using these insights to make my teaching clearer, more inclusive, and more effective. By bridging my teaching practice with my research in computer science education, I aim not only to respond to students’ immediate challenges but also to shape lasting improvements in pedagogy and course design that help all students succeed.

Building Welcoming and Engaging Classrooms

Besides effective instruction, I also aim to create a supportive learning environment where students feel comfortable engaging with instructors and peers. I hope students can trust that their efforts to take intellectual risks in learning will be met with support rather than judgement. While this may be an ambitious goal, I believe my teaching experiences at Illinois with disparate course formats and structures have equipped me with practical approaches to creating a supportive learning environment in various settings.

Computer Architecture used a flipped classroom format, with mini lectures followed by collaborative learning activities during hybrid class meetings. In a massive classroom like this, it could be really challenging to build connections with students and establish a welcoming environment. To prevent students feeling adrift, each day after the mini lecture, I checked up on each group, both in-person and online, asking how they were doing and whether they had questions about the lecture or the collaborative assignments. Initially, many students gave facade reactions, “We’re good. No questions at this point... Wait actually I didn’t quite understand—”, even though I had already frequently paused and solicited questions from students during the lecture. When this happened, I always validated their questions by letting them know that their peers had similar questions as well and answered their questions with enthusiasm and patience, which students recognized and commended later (“Hongxuan was always super helpful and his passion for teaching was very obvious. He would get excited when he would help us and we would understand the topic, which was very refreshing to see. He's awesome!"). I could feel that as the semester progressed, students became more comfortable asking questions during lectures and collaborative activities, and facade reactions significantly reduced. I believe that students felt shy to ask their questions in front of the whole class or raise their hands during group activities at

the beginning, but when they felt cared for and safe with me, they gained the courage to actively seek help and explore freely.

Similarly, I paid close attention to student participation when I co-instructed Discrete Structures through remote, synchronous lectures. Pausing during lectures and encouraging emoji reactions not only allowed me to gauge students' progress and difficulties in real time, but also fostered higher engagement. Initially, at each checkpoint I only asked whether students had questions, which often resulted in prolonged silence and little interaction. After adopting Zoom reactions, however, almost all students interacted with me using emoji reactions at checkpoints, and they became more comfortable asking questions during lectures.

I will continue creating classroom environments where students do not have to fake that they understand and feel comfortable asking questions or making mistakes. In addition, I will train my course staff to make sure everyone contributes to welcoming interactions with students. I believe that my passion for teaching and caring for students will be understood and appreciated, so that we can build a supportive and welcoming learning environment together.

Facilitating Persistence with Low-Stakes Course Policies

I am also interested in course policies that encourage perseverance and reduce attrition, as CS courses are often deemed too intimidating, especially for beginners. To lower the stakes of certain assignments and/or exams and account for unexpected situations, in Computer Architecture we had policies such as allowing homework to be submitted for partial credit after deadlines, offering second-chance testing opportunities, and providing optional practice assignments with extra credit. In addition, I have conducted research on a “split deadline” assignment policy in a massive CS1 course, where we found that staggering assignment deadlines could help reduce peaks of office hour traffic while maintaining fairness. I will continue experimenting with diverse course policies and learn from the CS/engineering education community, so that students can persist and thrive in my courses.

Looking Ahead

I am committed to constantly improving my teaching through the three lenses mentioned above—conceptual difficulties, learning environments, and course policies. I will leverage my research skills and experiences to innovate my courses and investigate the effectiveness of those changes. I am also interested in sharing my knowledge with other instructors and helping other courses improve together.