As a teacher and mentor, I aim to cultivate students' *agency and intellectual growth*, whether in the classroom or through research. To do this, I use a combination of hands-on practical instruction, interpersonal interaction around learning objectives, and individual accountability. Here, I describe how my teaching at the University of Chicago builds around these ideals and enriches the student experience on campus.

CLASSROOM TEACHING

During my time at the University of Chicago, I have developed new undergraduate curriculum in data visualization, contributing core courses to new degree programs in Data Science. In Spring of 2023, I began this endeavor by completely remaking **DATA 22700: Data Visualization and Communication**, the visualization requirement for Data Science minors, the original offering of which was created by instructional faculty without expertise in visualization. In reconstituting the course, I revised the learning objectives to focus more on the empirical science of visualization design, the conceptual frameworks behind modern computational tools for visualization, and practical skill-building with such tools. Drawing upon materials from world experts in visualization, I created a new sequence of lectures, exercises, and assignments to help students meet these learning objectives, as well as a new final project asking students to apply what they learned about visual data analysis to address a problem or question of their choosing.

In Fall of 2023, I forked these efforts to create **DATA 23700: Visualization for Data Science**, an accelerated course in visualization required for the Data Science major. To differentiate the course for majors from the course for minors, I expanded the materials around building interactive visualizations and conducting statistical analysis, challenging students to pick up new programming tools such as the JavaScript library D3 and various statistical modeling packages in R. This prepares students to use a broader swath of computational approaches to visualization and to integrate more fluently into teams of software engineers or statisticians. Both DATA 22700 and 23700 register large numbers of undergraduate students and continue to grow, as Data Science has quickly become the fourth largest major on campus.

I dedicated considerable effort to creating graduate curriculum at the University of Chicago focused on helping students build research and data communication skills. The most impactful if these offerings is **DATA 31500: Data Interaction**, a core requirement for both the new PhD and Masters of Science in Data Science degree programs. I conceived of this course in Fall of 2022, aiming to create curriculum that would differentiate our graduate programs in data science from those at peer institutions, specifically by emphasizing how perspectives about data interfaces from the discipline of human-computer interaction (HCI) are instrumental to becoming a great scientist and communicator of data. I launched the course in Fall of 2024, distilling some foundational materials on visualization from DATA 23700 and extending these with (i) a much greater focus on building bespoke interactive data interfaces in the web browser and (ii) a project that asked students to present original research in their intended area by the end of the quarter. This course provides both fundamental skills and a forcing function for graduate students to conduct research. It is cross-listed as CMSC 31550, so Computer Science students can take this as an HCI elective.

Additionally, I have offered a series of seminars under the course listing **CMSC 31801: Topics in Data Science**. These seminars also focus on building knowledge and skills required for research, specifically asking students to discuss visualization research, experiments in HCI, and statistical analysis. The most recent of these seminars provides a hands-on crash course in Bayesian regression modeling by working through the textbook Statistical Rethinking, addressing a gap in our graduate curriculum in Computer Science by teaching quantitative research methods.

I also co-taught the initial run of **CMSC 14100: Introduction to Computer Science I**, helping to reconstitute the first part of our Introductory Computer Science sequence. Although my role here was less central, this was a substantial contribution to the Computer Science department's undergraduate curriculum.

TEACHING PHILOSOPHY

The strategies and imperatives that guide my teaching center on the student experience, aiming to maximize hands-on practice, personal ownership and accountability, and in-person interactions with course staff. I summarize my teaching philosophy as *set of commitments*, describing how I work to enact each of them.

Put declarative knowledge into practice. Learning by doing makes abstract concepts concrete and actionable. It not only helps students connect ideas to applications; it also creates opportunities for critical dialogue [1] and reflection in action [2], which give space to students' voices in the classroom and promote a more expert-like closeness with course material. For example, in DATA 22700 and 23700, every other class session includes a flipped-classroom style exercise, where students spend class time "getting their feet wet" with new tools and frameworks with the supervision of course staff. Similarly, my graduate seminars tend to focus on participation in group discussions and worked practice problems, fostering open intellectual engagement with an eye toward how the material might be applied in our own research.

Structure content around learning objectives. Learning objectives create a contract between instructors and students that creates healthy systems of mutual accountability. Scaffolding ideas the instructor finds important can help students track their responsibilities and identify blind spots in the curriculum to be addressed in discussions. For students, I find that it helps to "cycle" on a given learning objective, and I structure my coursework accordingly. For example, in DATA 22700 and DATA 23700, I ask students to first attend lecture and learn new material by following a demonstration, then rehearse relevant skills and knowledge through exercises, and finally demonstrate mastery in assignments. My graduate courses ask students to be more independent, but they are still structured around units, each with a clear purpose.

Create opportunities for revision and growth. Without the chance to act on feedback and learn from mistakes, the value of evaluation for students is greatly diminished. After all, the purpose of grading and feedback is not to punish students for attempting something at the boundary of their zone of proximal development [4]. Students need the chance to show improvement, both to rehearse the lessons that come from momentary failures and to build confidence in their abilities and sense of belonging in the discipline. For this reason, I adopt specifications grading [3] in all of my courses, which emphasizes qualitative feedback over point systems. I pair this with a carefully designed resubmission mechanism, where I ask students to implement feedback and attend my office hours to discuss the core ideas that they seemed to miss the first time. After they do this, I correct update their score to reflect their mastery of the material. With similar motivation, I give project-based final evaluations that challenge students to push themselves.

Encourage one-on-one interactions. One-on-one interactions enable me to help students break down the problems they struggle with as individuals, which in leads to increased student engagement and ownership of learning, capacities that are especially important and challenging for students to build post-pandemic. My resubmission policies (described above) require students to come visit my office hours. Additionally, project-based evaluations ask students to engage in creative problem-solving with data, often leading them to seek out brainstorming sessions with me. These one-on-one interactions offer students a unique level of access to their professor, enabling dialogue and reflection that facilitate a healthier learning environment.

MENTORING AND OUTREACH

Involving students in research brings incredible opportunities for hands-on learning and growth through mentorship. I approach this work with great care, opting for a smaller lab which hosts closely supervised projects, offering students a lot of individual attention and constant feedback. My core philosophy in mentoring is to **pay it forward**, extending the unbroken chain of kindness and good will that has been instrumental to my career. I enact this through an openness with students and an abiding willingness to provide input on their problems, especially related to research or career planning.

The most profoundly transformative mechanism for this educational work is mentoring student research. I currently advise two PhD students and collaborate with a handful more, both in our department and beyond. Also, I hosted one undergraduate and two masters students as research interns, and I continue to explore such opportunities with interested students. My mentoring has led to student-authored publications in top venues for visualization and HCI. Sustaining these mentoring relationships, and using them to help students realize their career aspirations and create new knowledge, are among the most sacred duties of a professor.

Beyond direct mentoring, I keep my door open for graduate students in Computer Science and Data Science to seek input and feedback on their research. For example, frequently meet one-on-one with graduate students, even if I don't advise them. These meetings are often spontaneous in the hallways of John Crerar Library, but they are also often scheduled in advance whether over coffee or to give feedback on a job talk. I think in part as a result of this openness, I have been asked to serve on the committees of five Computer Science PhD students in two-and-a-half short years, including one student who became a professor at the University of Utah's world-renowned Scientific Computing and Imaging Institute.

Also, I pursue informal mentoring opportunities by participating in outreach efforts. For example, I frequently serve on panels hosted by the University of Chicago Data Science Institute (DSI) and the IEEE VIS conference, where I speak candidly about career planning and research strategy. I also regularly organize local meet-ups for visualization researchers in the Chicagoland area. Many of these events are informal social gatherings intended to help students network, but some are more formal events such as the first ever IEEE VIS Satellite event hosted on the University of Chicago campus, which I co-organized with DSI. Similarly, I lead research organizing efforts on campus such as the 2024 Visual Computing Area Meeting, which drew research presentations students and faculty from the University of Chicago Computer Science department and TTIC, and similar efforts related to coordinating three separate proposals for AI Pillars.

FUTURE PLANS

In future years, I will eagerly continue on the trajectory I have set, looking especially for ways to innovate in curriculum on data visualization and to involve more students in research.

To continue developing the courses I built in data visualization, I plan to refine them with new hands-on activities and updated content on a fast-moving landscape of research and tools. Some of my most ambitious goals are to create **novel educational games** that ask students to solve problems around data communication and statistical analysis. For example, in my most recent offering of DATA 23700, I piloted an exercise that I called, "the visualization persuasion game," which asked students to play the role of data providers competing for a contract. Each student receives the same dataset and restrictions on sensitive information they are not allowed to disclose. They must then produce visualizations that answer questions for a potential client, a role played by a different student, effectively using visualization to bid for the client's trust while respecting data sharing constraints. Games like this one blend my research with my classroom teaching by (i) requiring me to rigorously operationalize concepts like persuasion and deception, (ii) offering students hands-on opportunities to engage with new research, and (iii) creating a pathway for students' work and learning to inform my research. I also plan to continue updating my courses to reflect the latest tools for visualization authoring and evaluation, including new approaches incorporating generative AI.

I would also like to **expand access** to my visualization curriculum. Cross-listing DATA 23700 as an undergraduate elective for Computer Science would expand our department's offerings in HCI. Beyond the University of Chicago, I would like to explore ways to make some of the content I have developed portable to community colleges. To this end, I have already initiated a partnership with DSI and the City Colleges of Chicago to co-develop two-week modules in visualization for new Associates degrees in Data Science.

Finally, I would like to refine the ways that I **help graduate students cultivate research interests**. In DATA 31500, the onramp to doing original research is challenging in a nine-week quarter. I would like to explore ways to ease this process for students who struggle, perhaps with suggested project ideas or by working with DSI to connect Masters and PhD students with possible mentors. In my graduate seminars, I will continue to focus on research methods and epistemology, addressing gaps in our HCI curriculum.

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