

The fulfillment of being part of the intellectual tradition of mentoring and teaching is a key reason for my pursuit of an academic career. Evolving and growth as a teacher and mentor is a continuous process. I am fortunate to have started this process as a Ph.D. student by mentoring students and working as a teaching assistant.

Teaching. I strive to be an enabler of students' success in, and beyond the classroom. To achieve this, I apply four key principles in teaching. First, I focus on the *fundamentals* of the subject. Computer science is a dynamic field where the technical details are rapidly changing. Understanding the fundamentals is what will enable students to adapt to such a changing field. Second, I ensure that students understand the *context* of what is being taught. A common difficulty faced by students is that it is not clear "why" a certain concept is relevant and how concepts are related to each other. An end-to-end approach to show how the concepts are manifested in familiar systems and technology can greatly help provide the context and appreciation of the taught concepts. Third, the course must enable students to *independently* learn deep and cutting-edge topics. A course, due to time constraints, only touches the surface of a computer science subject. However, it can teach the tools necessary to enable students to independently learn new topics within the subject. This skill is vital for the students' future careers as they are more likely to face technical problems that were not explicitly taught in class. Finally, a teacher needs to keep students *motivated* by making classes and tasks more entertaining, thought provoking, and interactive.

As a Ph.D. student, I presented multiple lectures in undergraduate and graduate courses on databases and distributed systems. However, my primary teaching experience comes from working as the teaching assistant (TA) for the course "Advanced Topics in Distributed Systems." As a TA, I have helped write and grade homeworks and quizzes, prepare lecture slides and readings, and held office hours to assist students. Most importantly, I have taken the responsibility of designing the course project. My goal was to design a project that will make students combine and reflect on the concepts they learned in class and apply my four teaching principles. I wanted to tie the project to real world Internet Services that the students are familiar with (this provides *context*.) The project was to design a distributed system for micro-blogging applications (e.g., Twitter) that combines the course's various concepts, where I focused on the *fundamentals*. Also, the students were asked to ponder on whether it is possible to relax some of the project's requirements and still support the micro-blogging application functionalities. This stimulated students to *independently* combine advanced concepts from the course on consistency guarantees and application-level semantics to come up with relaxations and optimizations of the system's consistency. Students came up with excellent optimizations, some of which resemble recent top-tier published work in this area. I received the **Outstanding TA award** by UC Santa Barbara's Computer Science department for working as a TA for this course.

Another source of my teaching experience comes from preparing and presenting a 3-hours tutorial at the ACM International Conference on Management of Data (SIGMOD 2016) on the topic of global-scale data management. Working on this tutorial taught me how to present an area of cutting-edge research to an audience of academics and practitioners that are experts in other areas. This requires a unique set of skills to abstract the research area and present its salient features and challenges to a specific audience. These skills are important for my academic future as they apply to giving talks, short courses, and seminars. The tutorial will also be presented in the IEEE International Conference on Data Engineering (ICDE 2017).

Mentoring. I have mentored four undergraduate and three graduate students on advanced data management projects. My goal as a mentor is to train students to do independent and original computer science research, a skill that is not acquired in a regular classroom setting. Such a skill is important for students pursuing both academic and industrial positions, in a field where industry is rapidly adopting, and sometimes leading, cutting-edge research. As a mentor, I tailor the amount of practical and research work to match the student's background and future career plans. My experience as a mentor showed me that finding the right balance between hands-on and hands-off supervision is important to develop the student's independence and character as a researcher. Also, it enables students to pursue their projects in paths that are more suited for their interests and background. Repeatedly, I have been delightfully surprised by students taking their project to novel directions that I did not anticipate; and often, I ended up learning from the students as they became experts in their work.

Mentoring in Collaborative and Inter-Disciplinary Projects. The future of scientific discovery relies on collaborative and interdisciplinary research. Mentoring students working within collaborative and interdisciplinary projects is challenging due to the larger size of teams involved and due to the broader scope of projects that possibly span many scientific backgrounds. As a mentor, I trained students for two traits: *communication* to effectively exchange information with other parties, and *specialization* to establish and distinguish the scope and contribution of the student's work within the project. Out of the students I mentored, Ravi Kumar and Tanuj Mittal worked within a collaboration with Huawei, and Colin Biafore worked within a collaboration with UC Santa Barbara's Film & Media Studies department. My work with Colin started with a study on graph databases. At that time, I invited Colin to meetings with researchers from the Film & Media Studies department, where we discussed an ongoing collaboration to build data management tools for end-to-end analysis of online social trends. Colin iden-

tified a problem that was faced within this collaboration and proposed a solution based on his experience with graph databases. Colin's effective communication with collaborators enabled him to recognize the bigger picture and how he can contribute to the collaboration, and specialization enabled him to work on a project where he can leverage his expertise and advance the state of his research. Colin's work was presented in SIGMOD 2016 as part of the Undergraduate Research Competition [1], and later he was the Computer Science department nominee for UCSB's 2016 Undergraduate Research Award.

Courses. As a faculty member, my background equips me to teach undergraduate and graduate courses on data management, distributed systems, databases, and cloud computing. I will also be interested in giving advance seminars and lectures on Big Data systems, data management on emerging hardware architectures, systems for data science, and the theory of distributed systems and data management. In addition, I would be happy to teach undergraduate courses on networking, operating systems, and introductory computer science.

Education Technology. Technology and computer science are transforming education and learning. This is observed in the trends of education technology (*e.g.*, The Human-Computer Interaction conference CHI 2016 has two sessions dedicated to education). I am particularly interested in two emerging technology trends in the intersection of education and technology:

- *Interactive learning:* Interactive educational tools have the potential to enhance the learning experience. Recently, computer science academics have started implementing interactive textbooks, demonstrations, and visualizations to supplement traditional learning material. I plan to imitate and extend such experiences to the courses I teach. I learned the potential of interactive learning when I presented a demonstration of my work on data placement at SIGMOD 2016 [2]. I designed the demonstration as an interactive game, where players are presented with a scenario and are then invited to propose a placement strategy. The players were learning the challenges and trade-offs of the problem swiftly, while being motivated and entertained. This experience made me realize how interactive learning can transform education.
- *Diversity and inclusion:* Extensive studies have been conducted to propose methods of increasing diversity and inclusion in STEM. However, there are challenges to adopting and scaling these methods. Luckily, technology can be a facilitator of many of these methods. For example, having more *diverse teams* for class projects can promote a team-work culture that is more inclusive and less skewed to specific groups. This is challenging to implement given the demographics of today's STEM classrooms. However, with online resources and collaborative software, it is now feasible to pair students to form diverse teams even if the team members are in different physical locations and institutions. I plan to utilize my strong ties to institutions in the Middle East to initiate such efforts. I will also pursue engaging institutions in other parts of the world in addition to regional Minority-Serving Institutions to target racial and ethnic diversity. Likewise, I will pursue engaging departments of fields that have better diversity in terms of gender, gender identity/expression, and sexual orientation. There are many opportunities to pair computer science students with students in other fields, especially in capstone projects and introductory courses that can have real world applications in the sciences and arts. *Differentiated instruction* is another example that can be made more effective with interactive, online, and multimedia resources. I plan to draw on previous successful experiences to implement technology that facilitates and promotes diversity and inclusion.

As researchers in computer science, we are fortunate to have accessibility to the innovations in education technology, giving us an advantage and responsibility to adopt and demonstrate its potential.

References

- [1] C. Biafore and F. Nawab. Graph summarization for geo-correlated trends detection. In *SIGMOD*, pages 2247–2248, 2016.
- [2] V. Zakhary, F. Nawab, D. Agrawal, and A. El Abbadi. Db-risk: The game of global database placement. In *SIGMOD*, pages 2185–2188, 2016.