



2017 PRESIDENTIAL TEACHING AWARD NOMINEE

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My teaching philosophy is driven by the fact that we are facing a critical shortage of engineers in the United States. I have heard this numerous times from my industrial partners and I see it in the request for proposals being issued by the NSF and DoD that are asking the PIs to develop outreach programs at the middle school level as part of their research grant. Our stake holders are concerned by the lack of new engineers and the impact this will have on innovation in the United States. Some of the reason why we have an engineering shortage is self-inflicted. As a profession, I feel that engineers are not actively recruiting from two important segments of the population: women and minorities. My teaching has also been influenced by making the engineering profession more accessible and diverse. One of the reasons why I have enjoyed teaching at UIW has been the opportunity to increase diversity in the engineering field.

METHODS TO ENGAGE STUDENTS

Effective teaching of engineering classes greatly relies on how a professor conveys the technical subject matter to students. First, the lectures need to be well *organized and prepared* in such a way that the students will understand and be able to apply the subject matter. The student must know the structure of the day's lecture and what to expect during the course of my talk. Also teaching should involve mutual communication to inspire true learning and active thinking. During my lectures, I constantly prompt my students to ask such questions as what will be the next step, if this is true, or why this is true. I encourage and welcome questions from my students over the course material and try my best to address the questions promptly and effectively.

The feedback from students is important since this is later incorporated into improving my lectures and creating new courses. *Collaborative learning* in the classroom is key. I believe in giving in- class assignments where the students break out into small groups to work on a problem based on the day's lecture. This helps with subject reinforcement, subject clarification, and feedback on class understanding. Finally, accessibility is another aspect that is very important in the learning process. My students are always welcomed to the office for questions during and out of my office hours.

I strongly believe in *fairness*. It means treating students with an impartial attitude, but not an uncaring attitude. I emphasize the grading rules and class policies during the first class, syllabus, and on the course website. All my students are well aware that only their performances in homework, quizzes, exams and projects will determine their final grades. However, in my class I recognize *individuality* in my students by trying my best to make arrangements to accommodate their responsibilities to their jobs and families. I also believe in flexibility to address specific interests and concerns. During the semester, I constantly look at the results from exams and quizzes and ask the students for comments to see if I need to adjust the pace and content of the class.

I feel that providing undergraduate students opportunities for faculty lead research is an effective tool to improve the enrollment, retention/graduation rates, and marketability of our students. I am the Co-PI and Co-Director, along with Dr. Sreeranjini Nair, of the Autonomous Vehicle Systems (AVS) Research and Education Laboratory located in Bonilla Science Hall Room 319. The initial Phase I startup was funded by

the Air Force Office of Scientific Research. We recently won a Phase II expansion grant. The AVS Lab allows UIW students to perform autonomous vehicle research in a safe and controlled *indoor* environment. The time from concept to testing in the AVS Lab can be very quick so that the student researcher can spend more time experimenting and analyzing the results.

The AVS Lab currently has one full-time Lab Manager and a multidisciplinary STEM team of UIW undergraduate student researchers (3 seniors, 2 juniors, and 2 freshmen) all performing autonomous vehicle research in the areas of ground and air robotics. Our student researchers are not only engineering students but also biology and chemistry students which allows for diverse perspective. Everyone that is currently working in the AVS Lab has gone through a two-day Quanser training workshop last August to learn how to maintain and operate all the equipment in the lab; this includes flying the UAVs. Additionally, the CEO of Quanser visited us for a day and remarked on how our students embrace the UIW mission. The vendors training our UIW student thought they were all graduate students due to their technical ability, enthusiasm, and motivation. Quanser has remarked that it was the best workshop they ever had due to the amount of energy our students bring.

By focusing on the control of multi-agent systems in uncertain environments and introducing our students to concepts and ideas important to the mission of the DoD, the AVS Lab will have a direct impact on the national need for engineers familiar with the problem of autonomous ground and air vehicles. Students working in the AVS Lab will have skills that are easily transferred to graduate school and industry. The broader social impact will be seen in the largely minority south Texas region by broadening participation of underrepresented student groups in engineering. Closely supervised, the undergraduate students have made significant progress, publishing papers, and being recognized for awards in professional conferences.

PROFESSIONAL ACCOMPLISHMENTS

Over the past four years, I have had the pleasure of working with Tomas Goldaracena who graduated last December with a degree in Engineering. Dr. Nair and I had the opportunity to hire Tomas as a full-time AVS Lab Manager due to a grant from Quanser. Tomas represents what is best in UIW and I am proud that I had the opportunity to work with him. Tomas will be going to graduate school in Spring 2018.

Additionally, the last two summers, the AVS Lab hosted a one week summer camp for robotics and



engineering for middle-school girls called miniGEMS . The camp was funded through the Texas Higher Education Coordinating Board and we hosted 25 middle school girls and 3 middle school science teachers from underserved schools, free of charge each summer. This summer we plan to host four miniGEMS camps for middle school girls and an advanced robotics camp for graduates of mini GEMS.

Figure I. miniGEMS camp at the UIW Natatorium during Sea Perch underwater robotics Day on July 9, 2015.