

## Venkat Devarajan's Essay on Mentoring

While graduate *course* work tends to be somewhat regimented, research leading to a thesis or a dissertation is usually much more freewheeling and improvised. Inventions cannot be predicted anymore than the pitfalls that research students would encounter on their way to these inventions and new publishable ideas. Add to this mix, the differing personalities and experience levels of the students - you have a complex environment, where no single approach will succeed all the time. Thus, early in my tenure as a supervisor, I learnt to be adaptive and flexible without giving up the fundamental academic objective of creating top-notch science and engineering ideas and systems. I realized that each research student would need a different level of supervision and mentoring; some who would gain from close and frequent meetings, some that would need a moderate level of supervision and, some who should be practically left alone after the objectives of the research are firmly established. In all cases, some form of trajectory correction would be needed. And in all cases, *significant personalization* of the supervisory techniques would be required.

A second aspect of my mentoring is the respect that I show my PhD students as research colleagues. I am always aware that in a couple of years, these students could be Asst. Professors somewhere and, become my colleagues. I think it is very possible to be quite exacting in your expectations from your senior students, while giving them the respect that they deserve for having come thus far in their academic pursuits. When you operate thus, students actually work harder because they want to "look good" in your eyes. My respectful and informal attitude also makes for a pleasant atmosphere for the students at the laboratory, which is *always* good for productive research.

I learn a great deal from my students and then pass on those good lessons to my subsequent students.

I have a natural curiosity about ALL cultures of the world and this helps me develop rapport with the international students in our graduate program.

Having worked in the industry for over eleven years, I also bring to my supervision, additional perspectives of the real world. My students have made a point of appreciating me for this.

Now for the examples: Dr. Raj Iyer started as a master's student in my lab. He was smart and aggressive, simply brushed aside the course work

with a series of A's and, plunged head long in to research. At this time, I had developed an early version of a technology called FlexiCAD that I had hoped to commercialize. With his tremendous motivation and penchant for hard work, Raj was a perfect candidate to join me in this effort. We met and/or talked every day and, often, many times a day. We formalized FlexiCAD and came up with some other ideas that were later patented. Raj moved on to do his PhD under my supervision and our close association continued. As a part of his dissertation, Raj solved a well known open problem in computer aided design. He then joined our commercialization effort, worked very hard to bring it to a sustainable stage and, then moved on to work for a US Army research and development center. He is on the fast track to becoming a significant player in the Pentagon technology policy matters.

Dr. Xiuzhong Wang came to me as a PhD student. He is essentially a terrific mathematician. At the time he joined me, I had several funded projects in my lab. Instead of employing him to solve the most critical problem that I had, I let him associate with as many of them as he wanted, till he found what interested him. Unsurprisingly, that turned to be a challenging and open mathematical optimization problem. Once he found his niche, Xiuzhong became one of the most productive researchers that I have ever had. Week after week, he would excitedly show me the new and original mathematical derivations that he had developed. We have co-authored several journal articles. He is now the Director of R&D at a high tech company in Connecticut.

Dr. Bryan Bell worked full time at Lockheed Martin at Fort Worth when he met me and wanted to do his PhD. It was obvious that he was not a traditional student in terms of years of experience, maturity etc. He was clearly intelligent and mature, but had many misgivings about his ability to pursue his research with a full time job and family obligations. I worked with him and his boss, Dr. Brian Brumback, to properly define the scope of his research so that his work at his company could also be PhD level research. With the help of Dr. Brian Brumback, who heads an Advanced Research Lab, we found such an open problem. Bryan's solution was both theoretically interesting and later turned out to be very useful for the advanced aircraft that his company was developing - a multiple win situation. My role in Bryan's dissertation was to motivate him, helping him around some of the academic pitfalls with bi-weekly technical discussions. As a mature lead engineer at Lockheed, he needed little daily supervision. Dr. Bell is now a lead technical manager for an important aspect of a Lockheed Martin's F-35 fighter aircraft.

These are just three representative examples from the sixty plus students [I have mentored]. Not a day passes by when I am not grateful

for the variety, the intellectual stimulation from my graduate students and, the difference that I have had the privilege to make to some of these graduate students and their lives.

Sincerely,

*D. Venkataraj*

Dr. Venkat Devarajan

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