Tell us about Green River’s Physics Department.

The full-time faculty now consists of Ajay Narayanan, Chitra Solomonson, and me. We typically have three or four adjuncts faculty on staff as well as a full time laboratory technician name Brett Carroll. A major development, made possible through Ajay Narayanan’s enthusiasm, is the spectacular growth of our Society of Physics Students chapter over the past four years. The group meets every other week to share food, camaraderie, and physics experiments. While most of the membership comes from the ranks of our calculus-based physics class, the current president is an extremely enthusiastic student from our liberal arts physics class. The SPS chapter has been honored for excellence by the national SPS society as well as Green River’s student programs office.

Another development is the continuing evolution of Project TEACH, our math-and-science-learning teacher preparation program. What started as an idea of Marv Nelson [Long-time GRCC faculty member, now retired. In 1999, named Outstanding Undergraduate Physics Instructor in the United States.] and Stephen Kinholt [presently, an instuctor in GRCC’s Math Division], grew into a National Science Foundation [NSF] funded project with statewide responsibilities called the Center of Excellence for Careers in Education. Let me put this in perspective. When we applied for our first NSF grant for Project TEACH, we were told that we must have misunderstood. Two-year colleges do not train teachers. We feigned deafness and reapplied, prompting the NSF to give us a much smaller grant, less rope lest we hang ourselves. When that grant was evaluated the conclusion was that we had accomplished more with our small grant than some universities had done with much more money. [Additional] grants followed, from NSF, FIPSE, Boeing, Washington State, and elsewhere. Recently, Project TEACH geologist Bob Filson was awarded an NSF research grant to study whether completing Project TEACH courses influences the style of teaching of [preservice students] when they get their own classroom. This research...
is ongoing, but, in about eight years we have moved from “two-year colleges don’t train teachers” to “two-year colleges get grants to do research on the training of teachers.”

What have been some of the key factors in building a successful physics program?

A key factor has been the emphasis on teaching by inquiry. At a small college we have the flexibility to teach how we want and to modify our teaching with every class if need be. Should a given class have exceptional trouble with conservation of energy, we can spend more time on that topic. Part of that flexibility comes from eliminating the distinction between lecture and lab sessions. All classes meet in the laboratories and all classes are ninety minutes long. If in the course of working through an example the students seem particularly unwilling to believe Newton’s third law, the equipment required for them to test their ideas are only minutes away. “Labs” can be created and carried out in the middle of a class session. This environment helps to break down the idea that all knowledge comes from the instructor in front of the room.

One aspect that has been both a challenge and a key to our success is the support we have received from our administration. Whether amused or bemused by our odd way of doing things, our administrators have recognized that something good was going on in our classrooms and they have honored it and they deserve the credit for that. We are pretty lucky to have administrators who appreciate what we do. Another challenge has been the body of work involved with keeping quality high. Teaching by inquiry is more work than teaching by lecture. Fortunately the same innovation that creates additional work also keeps us fresh and involved with our classes. Teaching the way we do will never be easy, but I don’t think any of us would be satisfied if it was.

Green River is acclaimed for developing future K-12 science teachers. Why is teacher training important?

The short answer is that I have two kids in public school. I’ve seen the difficulties faced by teachers struggling to teach subjects for which they are poorly trained. My own work in local school districts agrees with studies done by local universities estimating that roughly two out of three elementary school teachers are unable to do simple proportional reasoning. Nevertheless, the new Washington State standards appropriately require our elementary students to learn about density, pressure, heat, temperature, and Newton’s laws. At some point we have to quit blaming the quality of our students on the teachers that came before us. If we could each give our local districts a handful of elementary teachers that are trained in these subjects every year then maybe someday we could see the quality of our incoming students improve as well.

Why do you prefer the inquiry method over traditional lecture?

My first year of full time college teaching was at Pacific Lutheran University. At the end of the year two students came to my office to thank me for the class. They were pretty good A-minus students but as we chatted I heard more and more errors and misconceptions in their thinking. Instead, what I saw was that these students had constructed superb mental highways that allowed them to move through the problems in the back of the text, but there were gaping chasms beneath the pavement. These highways were going to crumble at the first sign of a storm and I had done very little to prepare these students for that. Then I came to Green River, where I met Marv Nelson and learned that one could do inquiry exercises every day.

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Many students object at first since inquiry requires work on their part as well, but most come to enjoy it in time. My experience has been that all students benefit. The weaker students are able to fill in holes at their own rate, rather than getting left behind in a lecture designed for somebody else.
Would you agree that the typical two-year college lacks the resources to effectively teach inquiry-based physics?

I disagree completely. Most two-year colleges are small enough and flexible enough that they can quickly change curricula and adapt to their students. GRCC would not have the program it has today if we had to get a hundred or even a dozen physics faculty to agree to every change we have made. Class sizes are also usually smaller at community colleges than at local universities. Even the private liberal arts colleges in our area have seen the sizes of their introductory classes creep up in recent years. Because we “don’t have the resources” to do that, it simply isn’t a problem for us. We can add new sections if we can find available time slots during the day, but we keep our individual classes small, so any class session can feature inquiry exercises with individual attention from the instructor.

How would you explain your success in attracting women and minorities to physics?

Although we have been mystified by this ourselves at times, two things have come up over the years. One is the popularity of Physics 101 and Interdisciplinary Science class. Both classes are entirely inquiry-based. There is no textbook. Students work in groups to perform physics experiments and learn from the results. They discuss their results with each other first, smoothing out the roughest edges before they ever consult an instructor. I think this environment is much more comfortable and less threatening for students who may have grown up thinking they aren’t very good at science. As for the other classes I can only point to the use of inquiry and group work in those classes as well. Although our other classes do involve lecture and are not entirely derived from inquiry, the use of group discussion and inquiry probably still eases the transition for some "non-traditional" students.

What inspired you to become a teacher of physics?

Long story ... my wife and I were pre-meds. I took my first physics course in college because I wanted to be a physician. When the woman that was then my girlfriend expressed an interest in the Peace Corps, we got married and went to Kenya where we taught math and science. As expatriates in another culture, we hungered for stuff that reminded us of home. As a couple of science geeks, that meant the kind of intellectual stimulation that we were used to in college. Fortunately, there are merchants in Nairobi that grab magazines abandoned on airplanes and sell them on the streets. Whenever we went to Nairobi we bought every issue of Science and Scientific American we could find.

One night back at our school I lamented that I read the articles about medicine because I thought I should, but I read the articles about physics because I wanted to. My wife said, “You could be a physicist, you know.” The thought had never occurred to me before.

About eight years later I was finishing up my dissertation at the UW. I was offered a pretty attractive post-doc position and a temporary teaching job at Pacific Lutheran University [PLU]. I followed my heart. The job at GRCC came along a year later and although some faculty at PLU looked scornful at the idea of working at a community college, they quickly changed their tune when they heard it was Green River and that I would be working with some guy named Marv Nelson.Δ