PERSONAL OPINION

Academic Advising as an Aggressive Activity

William Yslas Velez

No question about it, in the area of mathematics, Hispanics in this country are definitely underrepresented. We all know it, we are all concerned about it, and for the most part the mathematics community has been ineffectual in its efforts to increase participation of Hispanics in mathematics-based professions.

I certainly do not have a solution to this problem; however, I would like to detail some modest successes I have had in increasing the number of Hispanic students who chose career paths in science, engineering, and mathematics (SEM).

Though my own focus has been increasing opportunities for Hispanics in SEM fields, my comments really have little to do with this particular population. The methods and ideas I wish to present are applicable to the entire student population. It is worthwhile to point out that at present I have over 35 minority mathematics advisees, six of which graduated in May 94. I expect that during the next academic year, I will see even more of these minority students graduating with degrees in mathematics.

Six years ago, Clark Benson and I (at the time, Clark was a faculty member at the University of Arizona, but he is now at the National Security Agency) decided to contact all of the minority students who were enrolled in first semester calculus. [Throughout this report, "minority" means Hispanic, African-American, or Native American.] This was an easy task as there were fewer than 25 such students. Our contact with them would be as follows:

A) We met with each student individually, each week, for half an hour. During this time we went over their homework with them, went over copies of old exams that we had saved, and discussed their progress with them in the course.

B) Once a week in the evening we met with the whole group of students and discussed the topics that they were presently studying. In particular we stressed test-taking strategies.

Attendance was always a problem. Students would not show up for their individual sessions and would skip evening sessions. Nevertheless, I did learn something useful from this experience. Students benefit from personal attention and even good students perform better when they have information on which to base their decisions.

Clark Benson left for the National Security Agency after that first year, and I continued with the same pattern for the next year. The number of students increased and it was getting harder to get students to show up for their appointments and to come to the evening group session; however, I continued talking to students, encouraging them to continue with their mathematics and science courses. During advising sessions, I encouraged some to join the student chapter of The Society of Hispanic Professional Engineers, a group for which I had recently become faculty advisor.

I was getting tired of students not showing up for their appointments and not coming to the evening sessions. I found myself spending too many depressing hours trying to contact students by phone. The increase in the number of students, as well as my frustration, forced me to change the focus of my contacts with these students. In the third year of my efforts, I gave up the evening session since I could never get enough students to show up. I was also being swamped by the number of minority students who were enrolled in our calculus classes. In Fall 1991, we had over 200 minority students enrolled in the first two semesters of our calculus sequence. Clearly I could not meet with this many students on a regular basis.

I decided to meet with as many students as possible for short periods of time and to be more focused in my contacts with them. The following was the plan: I would meet with minority students who were taking first or second semester calculus and hire a student assistant to do the phone contacts for me. The assistant's responsibility was to call the students and set up appointments for me, then call back and remind the students of their appointments.

My first contact with the student would be before the semester began, hopefully at least a month prior to the start of the semester. The first thing I would do is ask what their majors would be. Secondly, I would go over their schedules with them for the coming semester. This proved to be a tremendous service. Students can make the oddest decisions as to the courses they plan to take. I am a firm believer that the average student should take a light load the first semester that he or she is on campus. The transition from high school to college, the change in the emphasis of the course material, the lack of concern of many of our faculty for our students, and the simple fact of recently acquiring freedom are factors that in many cases prove too much for students. Miserable grades during a student's first semester in college can have disastrous effects on his or her self-esteem, grade point average, and ability to obtain scholarships and summer internships.

Many of the students that I saw were first-year engineering majors. These students had already been to see their engineering academic advisors. The advice that they were given was to take calculus, chemistry, a course in computer programming, English, and possibly one other course. I don't think that more than ten percent of the students could successfully complete such a course of study. This proposed course of study is, in my opinion, elitist. Its effect is to convince the majority of students not to study engineering. Students who, with a little time, would make very good scientists and engineers, are turned away at the door to these careers before they have a chance to peek in.

My next topic of conversation with the student was to discuss the choice of major with them. At this stage in their careers, most students are not aware of the vast possibilities. Students have heard of engineers, so students who are good at mathematics and science usually choose this major. One common response to the question as to why they chose engineering is that they were always good at, or always liked mathematics, and engineering is where mathematics is studied.

This point in the conversation allowed me to talk about the mathematics major. At the University of Arizona, the mathematics major has many options—pure mathematics, applied mathematics, probability and statistics, computer science, economics and finance, education, and engineering mathematics. This flexibility makes the mathematics major attractive. More importantly, so many options lend emphasis to the significance of including mathematics in the student's course of study. This is a point that I stress. Mathematics is the key to opening the door to a universe hitherto unknown to the student.

Many of the students that I have spoken with do not have a clear idea as to what direction to take, and here again I stress the importance of the choice of calculus. While the student is unsure of his or her major, it is sensible to take calculus since this choice keeps open many career options.

I should point out that in these conversations with students, it is not my intention to turn them into mathematics majors, nor do I encourage them to switch their major to mathematics. My aim is to pass on to them the enthusiasm that I have for my chosen subject of study, to encourage them to pursue their own academic interests, and hopefully to include a good course of study in mathematics, whatever their chosen major will be. In fact, it happens regularly that one of my mathematics advisees will abandon the mathematics major for another major, one more to his or her liking. When this happens I consider my advising of them to have been a tremendous success. That student has left with a solid foundation of mathematics for a major that has caught his or her interest. In many cases the student has taken more mathematics than the typical student in that major, so that student will have an even better chance at success.

I strongly believe that the mathematics community has neglected our undergraduate mathematics majors. These students have chosen a very demanding field of study, and except for presenting them with lectures, we have provided them with little more. Even the information that would allow them to choose between mathematics and other fields is not given to these students.

One of our complaints in academe is that high school counselors give bad advice. We presumably give better advice; however, a recent incident makes me doubt our own desire to provide sound advice to our university students. At a recent mathematics meeting, I was talking with a group of mathematicians and I brought up my aggressive techniques, in particular, that I discourage minority students from choosing a teaching major early in their freshman or sophomore years. I was surprised by my colleagues' reactions and opposition. Essentially, they were opposed to my methods for three reasons.

1. They considered it unethical to impose my views on these students.

2. There is a great need for good high school mathematics teachers, and students should not be discouraged from this profession.

3. There is a tremendous need for high school minority mathematics teachers, and I should encourage these students to go into this profession.

This makes me wonder what it is that university professors are telling their students.

I find the last reason the most onerous. When I was an undergraduate I was encouraged to become a high school Spanish teacher (not mathematics because this was presumably too hard for Hispanics) because I could be a role model for the students.

Many students coming to my university simply do not know of the opportunities for someone with a mathematics background, and these students simply gravitate to the teaching profession because they do know of that profession. This is especially true of young Hispanic women. It is my responsibility to acquaint these students with the myriad possibilities that exist. Though the teaching profession can certainly be a very fulfilling occupation, I do not think that we should funnel our students into it until they themselves are aware of the opportunities that exist.

There are some problems with my technique as it applies to those students who choose mathematics as their major. Students should be encouraged to get advice from many faculty members. I have sometimes misread the abilities of a student and given poor advice. And what do we do with students who graduate with mathematics majors and decide to become high school teachers? Certainly, we would like to see these students teaching mathematics since they have taken a large number of mathematics courses, but these same students must now return and spend at least a year obtaining the credentials to teach in high school. We need quicker transition of these students into the high school classroom.

The other very real danger in advising is the way the subject matter is organized in mathematics. I have seen many students do quite well in the mathematics courses offered during the first two years—calculus, differential equations, and linear algebra. Then they hit a brick wall, encountering our junior and senior level courses in algebra and analysis. For many of these students, it's as if they have begun the study of a completely different subject. But it is worse than this when some of these students realize they are not good at "real" mathematics. What is a student to do? What advice can be given in these situations? Students have to be monitored very closely as they make the transition from lower to upper division studies.

I would like to close with some recommendations to the mathematics community.

1. View your undergraduate mathematics majors as an integral part of the department. There should be activities which undergraduates are essential for running. Computer laboratories are an especially attractive option.

2. Encourage funding agencies such as the National Science Foundation to provide funds to hire undergraduates for activities essential to mathematics departments. Just as the laboratory sciences have a need for undergraduates, so must mathematics departments develop such a need.

3. Advising undergraduate students should be a priority in our departments. If, as a community of scholars, we cannot convince our undergraduates of the usefulness of mathematics, then who else can? We should make an effort to contact every calculus student in order to provide necessary information for that student to understand the importance of mathematics in his or her curriculum.

4. Increase summer internship opportunities. There are many in the mathematics

community who would welcome the opportunity to work with undergraduates if there were funds available to support these activities. We must not forget the opportunities that industry offers. Be more aggressive in convincing industry to hire mathematics majors, as summer interns as well as permanent employees.

5. The transition from lower division to upper division is a harrowing one for many of our mathematics majors. One of the main reasons for this is that "proofs" are part of the mathematical scenery of these upper division courses and in fact form a major part of the course content. Yet "proofs" are being de-emphasized in our calculus sequence. What can we do to make this transition easier?

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Struik To Deliver His Centenary Lecture

On September 30, 1994, Professor Dirk J. Struik will deliver his centenary lecture "Mathematicians I Have Known," at Brown University. The event is co-sponsored by Brown University, Providence College, and the American Mathematical Society.

For information, call (401) 863-2708. For dinner reservations, send $25 by September 15th to Brown University–Struik Dinner, Box 1917, Brown University, Providence, RI 02912. The lecture begins at 3:30 P.M. in Brown University's List Auditorium.

AP Calculus Exams To Include Graphing Calculators

Anita Solow

Beginning in May 1995, students will be required to use graphing calculators on the Advanced Placement (AP) Calculus Examinations. The multiple choice section will be divided into two parts. Graphing calculators will be needed for some of the problems in the second part of the multiple choice section and on the free-response section. They will not be allowed on the first part of the multiple choice section.

The AP Calculus Development Committee is a committee of the College Board, consisting of three college faculty and three from high school. It has specified what the capabilities of the technology are to be for the test. Students will be expected to have a calculator to:

A. produce the graph of a function within an arbitrary viewing window;

B. find the zeros of a function;

C. compute the derivative of a function numerically;

D. compute definite integrals numerically.

Not all graphing calculators have these capabilities as built-in features, but all can easily be programmed to perform them. Students will be allowed to bring programmed calculators into the examinations; calculator memories will not be cleared. In this way, the differences among the calculators can be minimized.

The decision to require graphing calculators was arrived at after lengthy discussion and study. Important issues that were considered included the decision's acceptability to colleges and universities that grant AP credit and/or placement, equity issues surrounding calculator use, the cost of calculators, and the readiness of high school teachers to use graphing calculators. The main reason that graphing calculators are being required is the belief that the use of graphing calculators can make the calculus course a better course, with increased student activity and discovery-based learning.

The next step, revising the syllabi for AP Calculus courses, will begin this fall. In the past there was a large common core of material in most college calculus courses. This homogeneity made designing the AP Calculus course relatively easy. Today the situation has changed, and there are many different calculus courses taught throughout the country. Although there is still much common material in calculus courses, it is approached differently in many reform settings. This makes it more difficult to create the AP Calculus syllabi. In addition, integration of technology into the courses creates pressure to change the syllabi. Some topics that were part of a standard curriculum become obsolete with technology, while other topics gain importance. (Of course, there are differing opinions about what these topics are.)

Over 100,000 students take the AP Calculus examinations, with more than that taking the courses. One consequence is that a large number of students will be entering colleges and universities with facility in using graphing calculators in their mathematics courses.

The AP Calculus program is not static. It has changed in the past and will continue to do so in the future. What is perhaps different now is that the changes occur at a quicker pace.