

Minority Calculus Advising Program
by
William Yslas Vélez

HISTORY

In 1988, Clark Benson (then a faculty member in the department) and I obtained the first in a series of four small grants from the College of Science to work on the retention of minority students in first semester calculus. We looked at enrollment in first semester calculus and found that there were about 25 minority students enrolled. A weekly review session in the evening was held and problems in calculus were presented. In order to increase attendance, pizza and sodas were provided. In addition to the evening session, Benson and I met with each student every other week to go over any issues that might have come up. This program continued for four years.

As time progressed the number of minority students in calculus began to increase and this time consuming interaction was no longer possible. A change in strategy was needed. I needed to formulate another strategy that would serve to increase minority retention and a strategy that was not so time consuming.

A description of these early activities can be found in the following article.

[Advising as an Aggressive Activity, FOCUS, The Newsletter of the Mathematical Association of America, Vol. 14 \(4\), August 1994, pp. 10-12](#)

THE ADVISING CHANGED ME

Prior to this advising program I had been an advisor to several mathematics majors. Typically I would meet with an advisee once per semester and go over their schedule. These advisees were already mathematics majors and my interactions with them were limited to looking at their progress through the mathematics program. This new advising program was different. The fact that I met so often with so many students changed my strategy for interacting with students as a professor. I listened more to their concerns, the problems they faced, the academic barriers that they encountered. Moreover, these students, for the most part, were not mathematics majors. Initially I just wanted them to succeed in their calculus course. Slowly it dawned on me to suggest taking the next mathematics course.

Around this same time I became faculty advisor to the student chapter of the Society of Hispanic Professional Engineers (SHPE). I tried to attend all of their weekly meetings and take seriously my position as advisor to these wonderful students. The national SHPE organization has an annual conference where the student chapters come together. I obtained funds from the engineering college to accompany the SHPE students to the conferences. Attending the conference with the students taught me a great deal about student attitudes towards opportunities that were offered to them. I met recruiters from several companies at this conference and these companies offered summer internships for engineering students! Why just engineering students? Because there was no tradition in mathematics departments to encourage their majors to apply for these internships!

These two experiences came together to forge my advising process. If the next mathematics course is beneficial for the student, then by applying induction we come to the conclusion that a mathematics major could be in the student's future. Initially I tried to get students to change their majors to mathematics. Bad

idea! This strategy annoys other departments, especially when you are successful in getting good students to change their major.

As I talked to recruiters I came to understand that recruiters value deeper mathematical knowledge. Though often recruiters don't advertise for mathematics majors they do understand that students who have mathematical talent can be good problem solvers. Students who combine mathematical knowledge with another subject would be more sought after.

Instead of suggesting to students to change their major, I started to suggest to students that they add the mathematics major. What are the benefits? Now there are two departments who are concerned about the welfare of the student. When a student completes majors in mathematics and some other subject they are more competitive in the workforce and certainly graduate programs appreciate the extra mathematical training.

Most students cannot complete two majors in a four year degree program (However lots of students take more than four years, so in five years it is certainly possible.). I suggest to students to add the mathematics major and I tell them that in a couple more semesters they will find where their interests lie. If it is in mathematics, then the other major can be changed to a minor. Or perhaps it is the other major that is more interesting to the student. Then mathematics can be changed to a minor. Both scenarios are common and when students drop the mathematics major, it is not a failure. Either way the student will have taken more mathematics and for a time the student had two advisors. Advising is very important for students. Even gifted students can be ignorant of the many opportunities that are available to them, including graduate school.

Getting students to add the mathematics major is but the first step. How do we motivate students to continue on with the mathematics major? Here is where the SHPE experience was so critical: summer internships with industry and summer research programs at universities. In my first meeting with students I present some opportunities and suggest to students to apply early. At different times in their undergraduate careers, students need information about different opportunities and if faculty and their major department does not provide this information, then who will?

After years of advising students I found that the following points shaped my interactions with students.

- 1 Good students need attention and advice
- 2 Advisors need to provide timely information
- 3 The transition from high school to university is hard on students
- 4 Students often choose engineering because they liked mathematics
- 5 Mathematics is a good major

THE ADVISING PROCESS

I wanted to impact minority students enrolled in calculus to motivate them to be serious about the calculus course that they were about to take and to impress upon them that doing well in their course work would open up opportunities for them. As I looked through enrollment records I noticed that we had many entering students who started in second or third semester calculus. These were either transfer students or students who earned credit for calculus in high school. I decided to expand the pool of students to the three semester calculus course. This increased the number of students but it was initially manageable. I used a variety of methods to contact them. I hired a student to call them and send them email messages. Due to limited resources, I settled on sending out emails. One of our postdocs, Erin Miltzer, introduced using Doodle polls to make appointments with students. Students would be contacted

and a twenty-minute appointment was made for the student to meet with me. This twenty-minute appointment is organized as follows.

Get to know the student - Go over the student's schedule. Look to see if it is reasonable. Is the student overloaded, which is common for a first year student? What was the last mathematics course that the student took? Does the student appear to be prepared for the upcoming course? If the student is not a first year student, inquire as to past performance in mathematics. Are there any changes the student could make in order to achieve better performance? If there were problems with past performance, has the student thought about what caused that poor performance? Does the student understand the university rules about dropping back to a pre-requisite course or dropping a course before the deadline? High school students probably have never experienced this.

University life – Many of the students that you will see are making a transition to university life. The pace of a university class is oftentimes two or three times faster than the same high school class. Moreover, there is more of an emphasis on understanding the ideas than in just doing computations. Most instructors do not take class role, so it is up to students to attend class regularly. Homework is important, even if it is not collected. Problems similar to homework often appear on exams. Does the student understand the support systems in place at the university? Tutoring programs exist around campus. Attending office hours is an extremely important educational experience. The instructor should be viewed as the best resource for understanding the material. Suggest to the student that attending office hours at least once every other week is the minimum. When a student needs a letter of recommendation, who will write it? If the student has taken the time to meet regularly with instructors then the student has created a support system and instructors who will know the student and can write letters of recommendation. The more connected a student is to the university the higher probability of success. Suggest that the student join a professional group in an area of interest. Students should be encouraged to form study groups. There is nothing like explaining a mathematical idea to another person. Such an activity serves to solidify that information in a person's mind. When a student is asked a question in a study group and the student formulates a reply, this is like practicing for a test. Suggest to students that they view the video, [**Community of Mathematicians**](#), that describes the importance of study groups and attending office hours. This video, among other things, appears on the following website, <http://math.arizona.edu/ugprogram/mcenter/resources>

Future Goals - What is the student's career goal? What does the student see himself/herself doing upon graduation? How can mathematics help the student achieve those career goals? Internship and research experiences enhance the undergraduate experience. Students with these experiences are more competitive upon graduation. Introduce the student to the following website: http://www.nsf.gov/crssprgm/reu/reu_search.cfm . Most students are surprised to learn that they get paid to attend a summer research program (These programs require letters of recommendation, so the importance of office hours comes up again.). It is a surprise to students to be told that, as long as your grades are good, graduate programs in mathematics, sciences and engineering pay the tuition and provide a stipend to attend. Talk about the kind of support that is available. You might think that this is a funny topic to discuss with a first year student, but introducing the idea of paid graduate school introduces a career path that probably has not occurred to the student.

Develop as a Professional- Students have to make a transition from being a student to being a professional. What is a professional (How does a student mimic this)? Finding a job requires that the student have a resume (A Sample Resume) and go through an interview process (Office hours, study groups, leadership activities in organizations). In an interview, students will be asked about their preparation for the position (Transcripts are your introduction and poor grades will stand out). Besides your coursework interviewers will want to know about your other activities (Internships, research and leadership positions). In the work environment, a professional performs a function (coursework) which

often includes making presentations (There are opportunities for students to attend conferences and give talks about their research.). Professionals belong to their professional organizations (students should join campus clubs).

The mathematics Major and Minor - Suggest to the student to think about adding the mathematics major or minor. Students with a background in mathematics and X are more competitive than just X. (Vélez & Aggressive Advising: If a student comes to my office enrolled in calculus and does not have a major declared, then with high probability the student will leave having declared the mathematics major.) Deciding to major in mathematics is not written in blood. However, while the student is a mathematics major that student is advised by a mathematician and there is one more department that is concerned with the student's welfare. If a student drops the mathematics major later on, then the student has probably taken more mathematics than most students in the student's major. This is beneficial for the student.

There are two worksheets on the website that go over these points and could be used to talk to the student.

THE PROGRAM TODAY

For several years the number of minority students enrolled in our three semester calculus course was around 300. Each of these students was sent a message from the mathematics department and encouraged to set up an appointment with me. Each fall semester, I would meet with about 100 of these students and go over the above mentioned points. Sometimes I would also do this in the spring semester.

In 2010 there began a dramatic increase in the number of minority students enrolled in the three semester calculus sequence. In fall 2012, there were about 750 minority students in this sequence! I was swamped, there was no way to meet with these students.

In summer 2011 I gave a talk about this advising program at the MAA Summer MathFest and at this talk I mentioned the recent increase in the number of students and the problem of reaching these students. In the audience at this talk was Erin Militzer, who held a post-doctoral position in the Department of Mathematics at the University of Arizona. After the talk Militzer approached me and suggested that she help me in organizing more of the teaching staff to join me in carryout out these interviews.

Militzer sent out messages to post-docs and graduate students in mathematics and applied mathematics at our home institution asking if they would be willing to take part in these advising sessions. A number of volunteers stepped up. Militzer suggested that I hold some informational sessions for the volunteers. After the advising sessions, the volunteers were asked to sit in on a couple of my advising sessions with the minority students. After observing the interactions between myself and the minority student, the volunteers were then asked to carry out their own advising session, using the worksheets as a guide.

Militzer organized the sending out of emails to the minority students and created a way for the minority students to select times for their appointments. In an effort to institutionalize the Minority Calculus Advising Program a postdoc will take on the tasks of recruiting other postdocs and graduate students to work on this project and to set up appointments with the volunteers.

The postdocs who have taken on this a role are as follows:

2011: Erin Militzer
2012: Erin Militzer
2013: Kristen Beck