Increasing the Number of Mathematics Majors

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University of Arizona
Tucson, Arizona
Focus

• The main focus of my work with undergraduate students is to get them to increase the mathematical content of their undergraduate curriculum.

• If the student chooses to add math as a major, that is just an added bonus.
Supportive Environment

• A) Universities need to recognize scholarship and teaching
• Our department has two Regent’s professors and three University Distinguished Professors.
Growth in the number of mathematics majors
Options available for mathematics majors

• Every mathematics majors takes the same core:
  • 3 semester of calculus, differential equations, linear algebra, introduction to proofs.

• After this core, students are required to take either 5 or 6 more upper division mathematics courses.
Options

1. Comprehensive
2. Computer Science
3. Economics/Finance
4. Probability / Statistics
5. General / Applied
6. Life Sciences
7. Teaching
8. Engineering Mathematics
Comprehensive Option

- Year-long course in abstract algebra
- Year-long course in advanced calculus
- Semester course in linear algebra
- Semester course in complex variables

- Students who are considering graduate school in mathematics choose this option.
- It is the most popular option.
Real Analysis of Several Variables
MATH 425B

Academic Year

# of students enrolled

YR 00-01  YR 01-02  YR 02-03  YR 03-04  YR 04-05  YR 05-06
Make-up of mathematics majors

- 1/3 are female
- 18% are minority (Hispanic, Native American, African American) students
- Over the last two years, we have graduated 6 Native Americans.
- This academic year we will graduate a record number of minority students, 17
Recruiting minority students

- I began twenty years ago.
- My initial goal was to help minority students survive calculus.
- The more I worked with minority students, the more I began to realize the important role that mathematics plays in their career choices.
- I slowly began to realize the benefits to majoring in mathematics, and making that recommendation to the students.
Calculus Minority Advising Program

• Each semester I obtain a list of minority students enrolled in our three semester calculus sequence
• I pay particular attention to Native American students.
• I send out emails to students about preparing for their first semester in college.
• Message to students
• Here is an example of my advising activity.
Here is the math department’s webpage (http://math.arizona.edu/~calc/) that contains the day-to-day calendars (It is the spring calendar’s, but nevertheless it will give you an idea as to the pace of the courses.) and suggested homework assignments. After you have reviewed your algebra and trigonometry, you should start looking at the homework sets. Try to complete the homework for the first chapter that will be covered in your course.

If you are taking math 129 or math 223, here is the website (http://math.arizona.edu/~courseinfo/common/studyguides.html) that contains old final exam questions for these courses. If you are taking math 129, go over the exam questions for math 124/125. If you are taking math 223, then go over the exam questions for math 129. Reviewing these exam questions should provide you with an idea as to how well prepared you are for the courses that you are registered in.

Here is the website for the mathematics department:
http://math.arizona.edu/
This website contains a good amount of information about the department that you will find useful.

If you are a mathematics major, then here is the website http://math.arizona.edu/mathmajors/ that you should investigate. In particular, click on “internships and outside programs” to begin planning for the future.
<table>
<thead>
<tr>
<th>TIME</th>
<th>NAME</th>
<th>CLASS</th>
<th>MISC</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00-10:20</td>
<td>Alicia</td>
<td>124</td>
<td>PREN</td>
<td>Hispanic. Fr, ENGR 102 and chem</td>
</tr>
<tr>
<td>10:20-10:40</td>
<td>Emily</td>
<td>223</td>
<td>PSYC</td>
<td>Hispanic. Fr, chem 103a</td>
</tr>
<tr>
<td>10:40-11:00</td>
<td>Ryan</td>
<td>223H</td>
<td>PRPH</td>
<td>White. Fr chem. 103a, Engr 102</td>
</tr>
<tr>
<td>11:00-11:20</td>
<td>Oscar</td>
<td>223</td>
<td>NMS</td>
<td>Hispanic. So, 125 D, has done poorly. a long talk</td>
</tr>
<tr>
<td>11:20-11:40</td>
<td>Jorge</td>
<td>223</td>
<td>MATH</td>
<td>Hispanic. Senior, Coming in from ---. If he does well, recommend RUSIS</td>
</tr>
<tr>
<td>11:40-12:00</td>
<td>Brian</td>
<td>124</td>
<td>PRCS</td>
<td>Black. Fr Mentioned adding math as a major</td>
</tr>
<tr>
<td>1:20-1:40</td>
<td>Adam</td>
<td>223</td>
<td>CVE</td>
<td>Fr. Blue Chip Program starts Sunday,</td>
</tr>
<tr>
<td>1:40-2:00</td>
<td>Claudia</td>
<td>223</td>
<td>AEE</td>
<td>Hispanic. Jr. 124 C, 129, D then C. taking physics 141</td>
</tr>
<tr>
<td>2:00-2:20</td>
<td>Sabino</td>
<td>124</td>
<td>MEE</td>
<td>Hispanic. Jr; 124, 129, 223, 254 all Cs. Why taking 124 over again. Math major?</td>
</tr>
<tr>
<td>2:00-2:20</td>
<td>Robert</td>
<td>250A</td>
<td>ELE</td>
<td>Hispanic. Fr; Eng and chem., H</td>
</tr>
<tr>
<td>2:20-2:40</td>
<td>Briana</td>
<td>223</td>
<td>BMB</td>
<td>American Indian/Alaskan Native. So. Her mom allowed her to take off work today to meet w/you. Eng and chem. H</td>
</tr>
<tr>
<td>2:40-3:00</td>
<td>Ezekiel</td>
<td>223</td>
<td>CHEM</td>
<td>Black. Jr. Must be transfer student</td>
</tr>
</tbody>
</table>
Lessons Learned

• Good students need attention and advice.
• Provide timely information to students, help them to understand the system and future opportunities.
• The transition from high school to university is brutal.
• Students oftentimes choose engineering because they liked mathematics in high school.
An example of trying to provide timely information

• The university sponsors a Career Fair in September.
• I attend and talk to recruiters.
• Here is a recent message I sent out to students.
• I want to emphasize that this is an ongoing conversation with students.
• In summer 06, we placed 38 students in summer positions.
Meeting with Recruiters

• The Career Fair took place this week. I stopped by on Wednesday and spoke with several recruiters. I thought I would pass on some information about internships. There are many internships available but there are also many students applying for these. I suggest that you begin applying.

1. The Applied Physics Laboratory at John Hopkins University hires about 100 summer interns. They said that it is possible to apply now for this coming summer. Here is the website: http://www.jhuapl.edu
   Apply for position #002018

   Of course, for those of you graduating, they are also looking to hire for permanent positions.
2. For mathematics majors who have an interest in business, perhaps double majoring in economics, I suggest that you go the website for Navigant Consulting:


They have positions for summer associates. Here is that website:


3. I visited with the folks from Micron. They said that they had positions for students in statistics. The website is: www.micron.com/college  <http://www.micron.com/college>

When I tried it said that it was down for maintenance
4. I spoke with someone representing the National Geospatial-Intelligence Agency. Though they don’t announce openings for mathematics majors, for those students who have minors in political science, there are opportunities. Here is their website:

www.nga.mil/careers <http://www.nga.mil/careers>

then click on: NGA student programs

5. Texas Instruments was there but I did not have a long conversation with them. They have summer positions available and they want you to complete a survey first:
here is the website: http://www.ti.com/recruit/studentsurvey.xls
Going back to Minority Calculus Advising Program

• Things to do to succeed this semester
**THINGS TO DO TO SUCCEED THIS SEMESTER**

1. If you are going to take first semester calculus, prepare for it by going to following sites and reviewing:
   - algebra: [http://prep.math.lsa.umich.edu/~u/PMC/](http://prep.math.lsa.umich.edu/~u/PMC/)
   - trigonometry: [http://math.arizona.edu/~trig/Math111_finalexam_studyguide.doc](http://math.arizona.edu/~trig/Math111_finalexam_studyguide.doc)

2. Office hours will be posted by your instructors. These office hours are meant for you. Use them. If the office hour schedule conflicts with your schedule, most instructors are willing to schedule appointments. See your instructors often. No one can help you like your instructor.

3. Do all of the work assigned. If the instructor gives points out for homework, then your goal should be to earn full points on each homework assignment. If you find that you do not understand some idea, get help immediately, either from the instructor or from some other source. Identify early the sources of help that are available.

4. Form study groups. Arrange to meet over the weekends. Exchange phone numbers among the study group members. You can earn leadership points by becoming a preceptor for one your courses. Go to the following website to look into becoming a preceptor: [http://teachingteams.arizona.edu/EP](http://teachingteams.arizona.edu/EP)

5. Join campus groups. Engineering students should consider joining SHPE (Society of Hispanic Professional Engineers).

6. Each semester you should update your resume.

7. Try to find either a summer internship or an opportunity to carry out a research project with one of the faculty. [www.blc.arizona.edu/ubrp/](http://www.blc.arizona.edu/ubrp/) [www.seds.org/spacegrant/programs/fellowships/internships/](http://www.seds.org/spacegrant/programs/fellowships/internships/)

8. Take charge of your education. Teachers can help you learn, but in the end, it is your education and it is your responsibility to ensure that your time spent with us will further your goals.

9. If you find that the major that you have chosen is not what you thought it was going to be and you want to talk to someone about changing your major, come by and see me. I look forward to having the opportunity to work with you in developing an exciting program of study. In particular, if you would like to know more about the mathematics major, and its many options, feel free to stop by my office.

William Yslas Vélez  Mathematics  East Building, Room 1 46C
Office Phone: 621-2259  E-mail: velez@math.arizona.edu
Send me an e-mail concerning__________
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   algebra:
   http://prep.math.lsa.umich.edu/pmc/
   trigonometry:
   http://math.arizona.edu/~trig/Math111_final_exam_studyguide.doc
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SAMPLE RESUME

Dorothy Villafuentes

Phone: (520) 902-1000
Email: dvillafuentes@email.arizona.edu

Career Goal: I am seeking a summer internship in an industry or organization where I can apply my mathematical knowledge and my analytical/problem-solving abilities. I have augmented my mathematical studies with courses in computer science and I am interested in finding a position where I can combine mathematical analysis with numerical simulations.

Education:
The University of Arizona, 2003-present
Major: Mathematics, Minor: Computer Science
GPA: 3.4, Major GPA: 3.5, Minor GPA: 3.4
Expected graduation date: May 2007

College credit earned in high school: I earned college credit for first semester calculus.

Computer skills: I have a solid general knowledge of computers as well as proficiency in Java and C.

Relevant coursework completed by May 2005:
Complex Variables
Computer science courses: Introduction to Computer Science, Programming and Design, and Object-Oriented Programming and Design

Other Relevant Courses: Two semesters of Chemistry and one semester of Biology

Work Experience:
I was an Undergraduate Teaching Assistant in Fall 2004. My supervisor was Dr. W. Valentoso. I tutored algebra four hours per week and developed several Excel spreadsheets for the business mathematics course for Dr. Valentoso. I also held weekly review sessions for the students in his course.

I held a Undergraduate Research Assistantship in Spring 2005 under the direction of Dr. Warren. I am investigating the practicality of reconstructing phase information from images taken in two different focal planes (the near field and the far field). This research will continue into next academic year.

Honors/Awards: I received Honorable Mention for Fall Semester 2003 and was on the Dean’s List for the other semesters. I am an out-of-state student and have been receiving out-of-state tuition waivers as a scholarship. I have also been part of the Honors College since my first year.

Activities: Since Fall 2004, I have been a member of Math Cats, the Undergraduate Mathematics Club. I have participated in several outreach activities sponsored by his club. I am also a member of the Microsoft Student Users Group: A club dedicated to the discussion of programming technology and theory, both of Microsoft and in general.

Volunteer Work: I was a volunteer mathematics tutor at a middle school (five hours per week) during the academic year, 2003-2004.

Citizenship: USA

Availability Date: May 31, 2005 – August 13, 2005
Try to find either a summer internship or an opportunity to carry out a research project with one of the faculty.

www.blc.arizona.edu/ubrp/

www.seds.org/spacegrant/programs/fellowships/internships/
If you find that the major that you have chosen is not what you thought it was going to be and you want to talk to someone about changing your major, come by and see me. I look forward to having the opportunity to work with you in developing an exciting program of study. In particular, if you would like to know more about the mathematics major, and its many options, feel free to stop by my office.

William Yslas Vélez   Mathematics East Building, Room 146C
Office Phone: 621-2259   E-mail: velez@math.arizona.edu
Send me an e-mail ________________
concerning________________________
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William Yslas Vélez
Mathematics East Building, Room 146c
Office Phone: 621-2259   E-mail: velez@math.arizona.edu
Send me an e-mail ______________
concerning_______________________
Aggressive Advising

• If a calculus student comes into my office and that student does not have a major selected, then

• I make them into a math major on the spot.

• Reaction from a C student
I take every opportunity to advise students

• My new strategy
• I look at the grades of students from the previous semester.
• I look at enrollments in our honor’s courses.
• I pay particular attention to first year students enrolled in second or third semester calculus in their first semester.
• I send out hundreds of email each semester.
An example of the messages that I send out to students

- Benjamin is a physics major

- Dear Benjamin:

  I was going over enrollments for math 223 and I came across your name. It appears that you are interested in physics. Have you ever thought of adding mathematics as another major? If you have any thought of pursuing an advanced degree in physics you will find that the undergraduate mathematics will be of tremendous assistance in that endeavor.

  If you would like to talk about these possibilities, send me a message and we can arrange to meet in my office. My office, Math East 142, is part of the Math Center.

  Best. WYV
The message ends with my titles, and contact information so that students know this is from a member of the department

William Yslas Velez
Director, Math Center
Math East 142
Associate Head for Undergraduate Affairs

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Tucson, Arizona 85721-0089

Office Phone: 520-621-2259
Fax: 520-621-8322
Office: Math East 142
website: http://math.arizona.edu/~velez/
Student’s Response

• Hi Mr. Velez,
I'm already planning on adding Geology and Astronomy as second and third majors.

• If this changes, I'll certainly consider the possibility.
Thanks,
-Ben
That sounds great. You might consider adding the math minor. After 223 and 254, you only need to have two more math courses to have the minor in math. After 254, I suggest that you take 422 and 410. If you are interested in declaring the math minor, let me know and I can make that change in your student records.

I wish you continued success. It is so great to know that there are such dedicated students as you.

Best. WYV
Hi Mr. Velez,
I'm considering switching to the Math major in place of Geology. The course load required for the Geology major in conjunction with Physics and Astronomy is absolutely overwhelming, and I had neglected to consider the honors requirements when I put my schedule together. I need to head down to Tucson to get my student ID and talk to the Astronomy advisor at some point in the near future. Perhaps I can come by your office as well?

Thanks,
-Ben
Now a math major

- What day do you want to stop by?

Best. WYV

- Ben has now declared math as a major, adding that to his physics major. His is enthusiastic about pursuing his studies.
Responses

- **Student 1:** Actually, I was thinking about it. I just have not had the time to declare the major and find out exactly what courses I still need to take in order to complete the degree. I have time tomorrow, or after spring break if you would like to talk about this more in depth.

- **Student 2:** Yes I have, and I am definitely interested in the possibility of adding math as a major. When would be a good time for me to stop by your office? Thanks in advance,

- **Student 3:** Yes, I have in fact considered a double major in math and physics. I am pursuing the B.Sc. degree in physics and plan to go on to graduate school. Since math is such an important part of physics, it would be a good idea to study as much math in my undergraduate career as possible.
• **Student 4:** I have given it a great deal of thought about changing my major to math. If I do not completely change my major to math, I still want to incorporate it in some manner (perhaps double major or minor). I was taking math 215 to pursue this. I have been wanting to talk to someone in the math department but I wasn't sure as how to do that. I would like it very much to discuss this possibility. Thank you for noticing my enrollment! It is greatly appreciated.

• **Student 5:** Thank you for bringing this possibility to my attention. I was actually considering double majoring in math because I find my current class quite interesting. It would be wonderful if I could meet with you sometime to discuss this. I looked through the profile you attached and was intrigued by it. Thank you again for your kindness.

• **Student 6:** I am actually a math-education major, I just haven't had a chance to get anyone to switch it officially, but I would like to talk about what kind of courses I have to take in the future to be a math teacher at the secondary level. Thanks for noticing:)