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# Whom Should We Recommend for Graduate Study?

*William Yslas Vélez*

**Manuel:** *I'm not going to graduate school in math.*

**Vélez:** *Okay, what is going on? Did something happen that you want to talk about?*

**Manuel:** *No, nothing happened. It's just that when I work with Rafael he picks up the ideas much faster than I. He seems to have a deeper understanding of the ideas and doesn't struggle with the homework.*

Manuel had come to my office for his spring advising appointment. I had just looked at his academic record, and it certainly looked positive: courses in linear algebra, advanced calculus, and probability, all with Bs. I was puzzled. Manuel was taking the second semester of advanced calculus.

**Vélez:** Manuel, how is this course going?

**Manuel:** Very well. I am enjoying the process of abstracting to higher dimensions in advanced calculus.

**Vélez:** And what about the other math courses that you have taken. Have you enjoyed them?

**Manuel:** I've enjoyed my math classes very much. I am also majoring in computer science because of job opportunities, but I like math more.

Manuel had come in to plan his schedule for the fall semester and his graduation the following May. Manuel needed to take only statistics to complete the math major requirements, yet he had added abstract algebra to his fall schedule. I asked why he was putting himself in situations where he interacted with students who seemed to be much better at mathematics than he is. His simple reply: “I just like mathematics.”

Although Manuel is interested in mathematics, he has gotten the message that Bs in mathematics do not lead to advanced mathematical study. Rafael, on the other hand, earns mostly As in his upper-division mathematics courses, but also has an interest in the life sciences and music. If both applied to the same graduate schools, Rafael would be considered more competitive. Which of the two students would be a better graduate student? More importantly if both chose to become professors, which of the two would be more effective in the classroom?

Why isn't a 3.0 GPA competitive for graduate school? Why are Bs so bad? Perhaps the belief is that if a student earns Bs as an undergraduate, the student would not be able to earn As or Bs in rigorous graduate courses. Is there data to support this belief? We have been running graduate programs for more than half a century—how introspective have we been about our application process and using our program successes and failures to inform what kind of student to accept (<http://bit.ly/2DCBPDw>)?

I do not recall having received any training about this when I became director of our graduate program. I sus-

pect that this is still the case in most departments. Graduate programs would benefit from an investigation as to what makes a successful candidate and, just as important: what are the internal requirements of graduate programs that help students successfully complete their graduate studies?

Manuel enjoys his mathematics classes, Rafael excels in them. Who will make a better professor? Graduate programs construct their doctoral programs with the view that they are producing research mathematicians. This is an illusion that defines and constrains the preparation of future mathematicians. J. W. Grossman, in “Patterns of Research in Mathematics,” reviewed the publication habits of mathematicians for the preceding 60 years (<http://bit.ly/2AhaFOh>). Grossman found that 43 percent of all authors had just one paper, with median 2 and mean 6.87, with a standard deviation of 15.35 papers. Approximately 75 percent of authors published five papers or fewer. It would be nice to have an update of this study.

This study clearly shows that our graduate programs do not primarily produce researchers. The great majority of the graduates who hold positions at universities spend most of their time in non-research-associated activities—teaching, running a department, educating future pre-college teachers, research experiences for undergraduates (REU), outreach, and mentoring. Many graduate programs continue to produce mathematicians who have not had a substantial teaching experience and have not had an opportunity to become involved in the

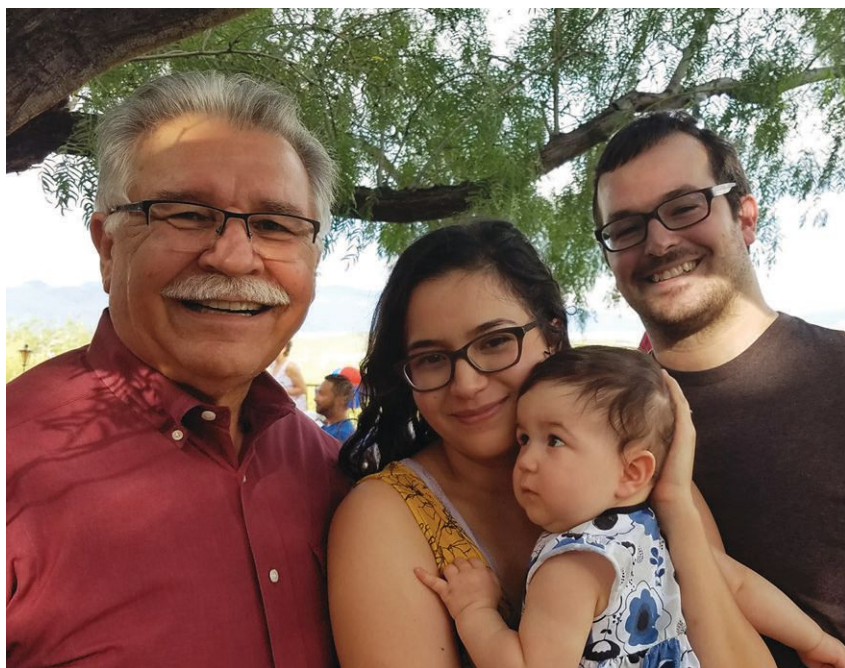
above-mentioned activities as part of their graduate training.

Given that the majority of academic mathematicians will teach for a living, I return to Manuel and Rafael. Who will make the better teacher? Is it Manuel, who has struggled with the concepts, has managed to come to an understanding of them, and is enthralled by the ideas? Or is it Rafael, who breezes through the undergraduate courses? Having empathy with students who struggle is an asset for those who teach.

Are our graduate programs weeding out the Manuels? Are faculty discouraging these Manuels from pursuit of graduate study? I am one of those Manuels who graduated with a 3.0, though by a miracle, I got into a graduate program. ■

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*Vélez helped Daniel Cross apply to Rice, where he just completed his PhD in statistics. Cross's wife, Cristina Retamoza, was Vélez's undergraduate advisee. Vélez hopes their baby will be a math major.*