

November 1/2017

VISION FOR THE MATHEMATICS DEPARTMENT 2018-22

I thank the Math Department and the College for this opportunity to be considered for reappointment for another term of four years. Being Chair of the Math Department is in fact a job that I love to do. This job often involves finding ways to implement many creative ideas and initiatives of the faculty, postdocs, (ZAPs, RAPs, VAPs), lecturers, staff and graduate students.

For the next four years, I envision the Mathematics Department as continuing its own process of becoming more outward looking, interdisciplinary and collaborative, in terms of its research, its teaching and its service missions. I see the Math Department as gradually becoming more welcoming of partnerships in research and education, with other units, with other institutions, and with the private sector.

As examples of this departmental movement towards collaborations and partnerships I note, first of all, the research collaborations with faculty from the Statistics and CSE departments, which have led to large NSF grants, such as the RTG grant in topology and the TRIPODS grant in data analysis. As a second example, I note the development of new collaborative networks of faculty started in our department, such as the STEAM factory (see <https://steamfactory.osu.edu/>) and the Erdos Institute.¹

In education, a more collaborative environment is manifested through the activities of the Math Education Forum² which has been working with other departments, rethinking the way instruction is delivered in many service courses. I note the success of one of our faculty members, Prof. Jim Fowler, in developing a Calculus MOOC which, according to Forbes, went viral. I also note the development of an open source (free) calculus textbook with other free textbooks to follow. In educational outreach, our Ross Program for high school students is 60 years old and recently opened up a parallel program in China: Ross/Asia.

At the level of the state, I note our participation in the Ohio Math Initiative and the development of the University System of Ohio (USO) Mathematics Chairs Network. Through this network the Math Department has an impact at the level of the state of Ohio, and nationally, when emulated in other states. This team effort in Ohio has been featured as a

¹Both founded by Prof. Holowinsky with the involvement of other faculty and staff at OSU

²The Math Education Forum includes staff from the MSLC, members of the Teacher-Training Group, lecturers, tenure track, and associated faculty.

success in various national conferences, for example “*Multiple Pathways: A Successful Case Study*” in <http://www.tpsemath.org/chairs2016>.

In terms of our effort to diversify the graduate program, I note our partnership with the Math Department at the University of Puerto Rico at Mayagüez, which resulted in the SAMMS program³ for underrepresented minorities. SAMMS already ran seven times.

Finally, I note our collaboration with a new Math Advisory Board consisting of friends of the department and alumni. The board has brought to the department a renewed interest in mentoring our undergraduate majors, emphasizing communication skills and connection with the private sector. This will benefit, in particular, students who seek employment right after graduation.

Continuing to move the department in a more collaborative direction is a goal which is well aligned with national trends in the field of mathematics, for example, as expressed in the document *The Mathematical Sciences in 2025* (Math 2025) of the Committee on the Mathematical Sciences in 2025.⁴

I start off with several positive developments (listed below) in five general areas, that have occurred in the department in the period 2010-17 during which I have been Chair. I then propose several related goals which are well-aligned with our 2014 departmental Strategic Plan and, in general, with national trends in mathematics as proposed in the document Math 2025.

SEVERAL SUCCESSFUL CHANGES IN THE MATH DEPARTMENT IN THE PERIOD 2010-2017

(1) **Faculty**

- ✓ **At the Columbus campus, 27 tenure-track faculty members (25 FTE) were recruited or hired and 4 at regional campuses over 7 years.** In the Columbus campus these hires have compensated for departures and retirements.⁵ Several of these faculty members have received NSF CAREER awards and Sloan Fellowships (see Appendix). We developed a strong TGDA⁶ research group and also filled the Eminent Scholar in Scientific Computation position, when we successfully hired Prof. Dongbin Xiu.
- ✓ **The number of postdocs (Visiting Assistant Professors or VAPs) was increased.** Relative to 2010, we have increased the number of VAPs by six. The

³Sampling Advanced Mathematics for Minority Students

⁴of the Board on Mathematical Sciences and Their Applications, the Division on Engineering and Physical Sciences and the National Research Council of the National Academies.

⁵61 faculty members in 2017 vs. 60 in 2010 in terms of FTE.

⁶Topological and Geometric Data Analysis

current number of postdocs essentially matches the highest number of postdocs that we had under the VIGRE grant.⁷

Five of these six positions are partially funded by external sources (NSF, Air Force grant), or the Eminent Scholar fund.

(2) **Research Infrastructure**

- ✓ **The Mathematics Research Institute (MRI) funding was increased from \$154,000 in 2009-10 to its present budget of \$300,000.**⁸ The increase in funding was accompanied with an increase in activity and impact. For example, in 2016-17, 205 MRI visitors and invited seminar speakers, from 116 different universities or research institutes worldwide, came to the Math Department to interact with our faculty.

(3) **Graduate Program**

- ✓ **The number of Presidential Fellowships awarded to the Math Department per year almost doubled.** We had 11 Presidential Fellowships awarded to our graduate students in the period 2010-17 and only 6 awarded in the period 2002-09.
- ✓ **The teaching load of graduate students was lowered by securing more OSU fellowships and using our SGA program.** In 2017, the equivalent of 22 additional Math graduate students are not teaching at all during the entire year.⁹
- ✓ **A record number of GATA awards received.** In 2017 two GTAs in our department received Graduate Associate Teaching Awards (GATA) and one more received the Outstanding Graduate Student Teaching Award from the college of Arts and Sciences. Moreover, in 2017 three GTAs were awarded GATA awards. The fact that this year the Mathematics Department received 20% of ALL GATA awards in campus (and last year 30%) is remarkable.

This is a great achievement of these graduate students and also of the team in charge of our GTA training, led by Dan Boros, John Lewis and Deborah Stout.

(4) **Undergraduate Program**

- ✓ **The number of undergraduate majors more than doubled.** We have increased the number of departmental majors from 646 in 2010 to 1391 in 2017.

⁷The peak in the number of postdocs happened in 2005 when we had 21 postdocs. The average number in 2002-08 under VIGRE was 18.7 We currently have 20.

⁸In 2017, 80% of the current MRI budget (of 300K) is backed by departmental "PBA" (continuing funds), F&A (overhead from grants) and research funds from Simons grants. The remaining 20% of the funds consists, on average, of 15% of the total funds available from unpaid LOA, FPLs and course buyouts.

⁹SGAs -Special Graduate Assignments-are use our Selective Investment fund.

(5) Staff

- ✓ **Four Outstanding Staff Awards (OSA) and two Distinguished Staff Awards (DSA) received.** The four OSAs correspond to about 8% of all the OSAs awarded at the College of Arts and Sciences. In addition, two nominees of the Math Department received Distinguished Staff Awards. One of the nominees works in our department, but is technically in a different unit (see Appendix).

This means that 15.5% of the current Math Department staff received a major university or ASC award in the period 2010-17.

In 2010, the department introduced the Staff Executive Committee (SEC). The SEC has nominated staff for important college and university awards and polled the staff about issues that need to be addressed.

CHALLENGES, GOALS AND INITIATIVES FOR THE NEXT FOUR YEARS

(1) Faculty

Tenure track faculty: The Math Department faces a wave of retirements in the next five years, since as many as 21 faculty members from the Columbus campus could retire.¹⁰ Excellent faculty hires in the next five years should be one of the department's top priorities. This is an opportunity to improve the department and to increase the diversity of its faculty.

Numerically, a goal should be to hire at least 4 tenure track faculty members per year in Columbus in the next five years, in anticipation of this wave of retirement.

Moreover, paraphrasing some of the language of our current Strategic Plan, the aim is to hire:

- (a) faculty in core areas of mathematics that can communicate and collaborate with faculty in other areas of mathematics in our department and
- (b) faculty that can communicate and collaborate with scientists in areas outside mathematics where mathematics is increasingly relevant.

The Math Department should

- (c) aim to maintain departmental areas of strength e.g., research groups which currently attract graduate students, postdocs and external research funding
- (d) hire faculty in research areas such as applied probability or stochastic DE “to build missing bridges in subareas of applied math and serve the explosion of undergraduate majors.”¹¹

¹⁰Based on reaching 65 years of age or 35 years of service in the next five years.

¹¹Actuarial Science and Financial Mathematics undergraduate majors together constitute about 68% of the undergraduate majors who have already chosen a track

Tenure Track Faculty at the Regional Campuses: The Math Department should continue to make sure that regional campus faculty are well integrated into the life of the department. In particular, the Math Department should continue to provide a supportive research environment for this group of faculty. This means

- (a) providing office space for regional campus faculty when they come to Columbus
- (b) providing adequate support, through the MRI, to organizers of seminars or conferences
- (c) facilitating regional campus faculty participation in the graduate program, for faculty members who wish to work with graduate students
- (d) making appropriate arrangements so that regional campus faculty members can attend remotely colloquia and seminars.

Visiting Assistant Professors (VAPs): The department should be committed to mentoring VAPs and prepare them for the process of securing a job after they complete their stay at OSU. This includes providing feedback when evaluating their teaching, and guidance in their research.

(2) **Research Infrastructure**

Mathematics Research Institute (MRI): The MRI plays an absolutely crucial role in the research life of the Mathematics Department. The MRI funding should be maintained or expanded and the importance of the MRI should be constantly communicated to the College.

Mathematical Biosciences Institute (MBI): The Math Department should continue its strong support for the MBI.

The challenges the MBI faces in the next few years are (i) to successfully compete in the next NSF Math Institutes competition in 2020 and (ii) to diversify its sources of funding aiming from other sources of grants, i.e. NIH.

Phase 2 of TRIPODS grant: The Math Department should help sponsor TRIPODS phase 1 activities so that the TGDA group can be successful in phase 2 leading to a national institute in data analysis. For example, resources from the MRI can be used, with MRI organizing emphasis years which are aligned with TRIPODS activities, especially in the crucial year 2018-19.

I note that there is coordination between the Mathematical Biosciences Institute (MBI) and the activities of the TRIPODS grant. The Math Department can leverage the MBI in order to help secure TRIPODS phase 2 funding.

(3) Graduate Program

The following are several important goals for the next four years to help increase the quality of our graduate program.

Continue the process of reducing time-to-degree in the Ph.D. program to ≤ 6 years. Five year averages of time-to-degree in the Ph.D. have gone from 6.8 years to 6.4 in a 20 year period. Securing fellowships to help reduce the workload of graduate students as GTAs is essential. Several structural changes were already carried out by the Graduate Studies Committee which should help reduce time-to-degree.

Continue increasing the Ph.D. completion rate to 80-90%. Five year averages of Ph.D. completion rates have gone from 39% to 69% over a 20 year period. These are then averages corresponding to entering classes 1995-99 and 2005-09 which includes students who finished in 2016.

Increase the visibility of interdisciplinary research in our department by creating a new interdisciplinary Ph.D. track. At present, students primarily come to OSU to work in core mathematics. An interdisciplinary track in the Ph.D. would help make interdisciplinary graduate programs more visible, and would allow our department to accept talented students with less traditional math backgrounds. I note that there is already a committee of the GSC, led by Prof. Tien, working on this project.

Diversify the graduate program, aiming for at least 30% of women. The percentage of women in our graduate program (Ph.D. and MMS programs) in 2016-17 was 19%, and the new entering class of graduate students has 26% of women. In spite of this, due to graduation or attrition, in 2017-18 we only have 15.5% of women in our graduate program. These numbers are clearly very low, even when we compare ourselves with peer institutions. For instance, our benchmark institutions, according to AMS data, have on average 30% women in their math graduate programs.

An interdisciplinary track in the Ph.D. program could help attract women, since the vast majority of the women in our undergraduate major are in interdisciplinary tracks. Moreover, our MMS program tends to attract more women and members of underrepresented groups. So, having an interdisciplinary Ph.D. track may allow for a smooth transition from the MMS into our Ph.D. program for talented MMS students, and may help diversify the Ph.D. program.

*Continue the new seminar *Invitations to Industry*, perhaps make it into a course.*

Continue the summer training of our graduate students as GTAs which has been so successful recently. This training should accommodate our growing needs for GTAs who teach in Active Learning sections of Calculus and other courses, such as Math 1116 (Quantitative Reasoning).

(4) Undergraduate Program

Math majors

Properly advising and mentoring almost 1400 majors, considering that at present we only have 61 faculty members in Columbus and four counselors, is a great challenge. More concretely, coordinating with the Math Advising Office:

Develop a peer-mentoring program for our math majors. For example, requiring that recipients of scholarships be mentors, and coordinating with students organizations to organize activities that help mentor students.

One of the purposes of the mentoring of students is making sure that they are ready for the job market:

Ensure that students have the skills to be successful in the job market. For example, invite recent graduates to describe their experience in the job market to undergraduates through our Introductory Seminar (Math 1295), or through activities of student organizations, such as the AWM.

Incorporate communication skills as part of the curriculum, especially for the majority of students who seek a job right after graduation from OSU. This can be done through a capstone course which emphasizes written projects and oral presentations.

Increase the diversity of our Honors Program. We have, perhaps the best Honors Program at OSU which other institutions try to emulate. However, we have very few women in our Honors Program (12%) and this percentage has not improved since the issue was identified in 2014 during our External Review. We are already taking action to try to increase diversity by (i) making structural changes in the traditional honors program, (ii) introducing several new interdisciplinary honors tracks and (iii) recruiting high-achieving high school students nationwide.

Therefore:

Develop a new interdisciplinary Honors Program. The aim is that students in every track in the major have a path to an honors degree. A Committee, chaired by Prof. Keyfitz, is already working on this project this fall.

Service courses

The following are three goals for service courses:

Drastically reduce the need for math remedial courses at OSU with the development of a new Quantitative Reasoning (QR) Course for majors not requiring calculus. Such a QR course is being piloted this fall and will be fully implemented in the Spring in Columbus, with implementation in 2018-19 at regional campuses.

Lower the DEW rate in Calculus I (Math 1151). The Math Department has developed a two-semester version of 1151, “*Calculus with Review*” (Math 1140 & 1141) for students who are likely to fail 1151 in its standard one-semester form. The Calculus with Review is being piloted this year in our department. Math 1140 & 1141 are expected to lower the DEW rate in Calculus I.

Develop free textbooks for some of our main courses. We have about 10,000 students per year in all of our calculus sequences (Calculus 1, 2, 3, Business Calculus, Accelerated Calculus, etc.), and the savings would be substantial every year. The OSU-developed textbook will already be used in all Math 1151 (Calculus I) sections in the Spring of 2018.¹² The Math Department has just received ALX grants to develop these textbooks for Calculus 1, 2 & 3 for a total of more than \$70,000 from the Office of Distance Education and e-Learning (ODEE).

Plans for the development of textbooks for other courses, e.g. Linear Algebra, are already underway.

(5) **Staff**

The SEC is an important committee in the Math Department. One goal is for SEC to conduct a poll of the staff every year about issues of concern, based on which a yearly meeting with the staff and departmental administration will be held in which these issues will be discussed. In the past, two important issues have been the salary process and computer support.

Finally, I am very optimistic about the Mathematics Department in the future. For example, we are on a good path in our graduate program. Since changes were first introduced in 2008, our graduate ranking in US News and World Report has improved from # 33 in 2008 to # 28 in 2017.

Moreover, I know that the work done by members of our department is highly valued at the College, at the Provost’s Office and at the Ohio Department of Higher Education. In fact, the College has substantially invested in the budget of the Math Department in spite of having budgetary difficulties of its own. I then expect to be able to convince the College and OSU to continue to properly fund our operations, and to continue to invest in faculty hires in the future. This investment is critical at a time when we face a possible wave of faculty retirements.

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¹²This effort involves faculty, staff and at least one postdoc (VAP).

Appendix

Winners of GATA awards and the ASC Outstanding Graduate Student Teaching Award

2017: Duncan Clark (Outstanding Graduate Student Teaching Award 2010-17)
 2017: Daniel Glasscock and Shenhui Liu (GATA)
 2016: Osama Khalil, Sean Meehan, Katie Ritchey (GATA)
 2012: Bora Bosna (GATA)
 2007: Vaidy Sivaraman (GATA)
 2001: T.J. Duda (GATA)
 1998: Dan Boros (GATA)
 1994: Tony Nance (GATA)

Winners of Presidential Fellowships 2010-17

2010 Fabrizio Polo, Justin Lynd,, Zhizhang Xie,
 2012 Rudy Perkins
 2013 Kun Wang
 2014 Zhi Qi, Benjamin Schmidt
 2015 Joel Moreira
 2016 Irfan Glogic, Han Baek Lyu, Fenglong You
 2017 Florian Richter

NSF CAREER awards 2010-17

2017: David Penneys, Yulong Xing
 2016: Adriana Dawes, Chuan Xue
 2015: Tasos Sidiropoulos, Dan Thompson
 2014: Matt Kahle
 2013: Ching-Shan Chou
 2010: Janet Best

Sloan Fellowships 2010-17

2012: Matt Kahle
 2011: Roman Holowinsky
 2010: Janet Best

Winners of Outstanding Staff Awards (ASC) 2010-17

2014 Diana De Vol Bevilacqua
 2013 Dave Alden, Elizabeth Miller
 2011 Jack Zuefle

Winners of Distinguished Staff Award (OSU) 2010-17

2011 Phyllis Rawlings ¹³.

2013 Darry Andrews

¹³from Facilities Operations and Development but nominated by our department